$15,000 PC Programming Contest—see page 10.

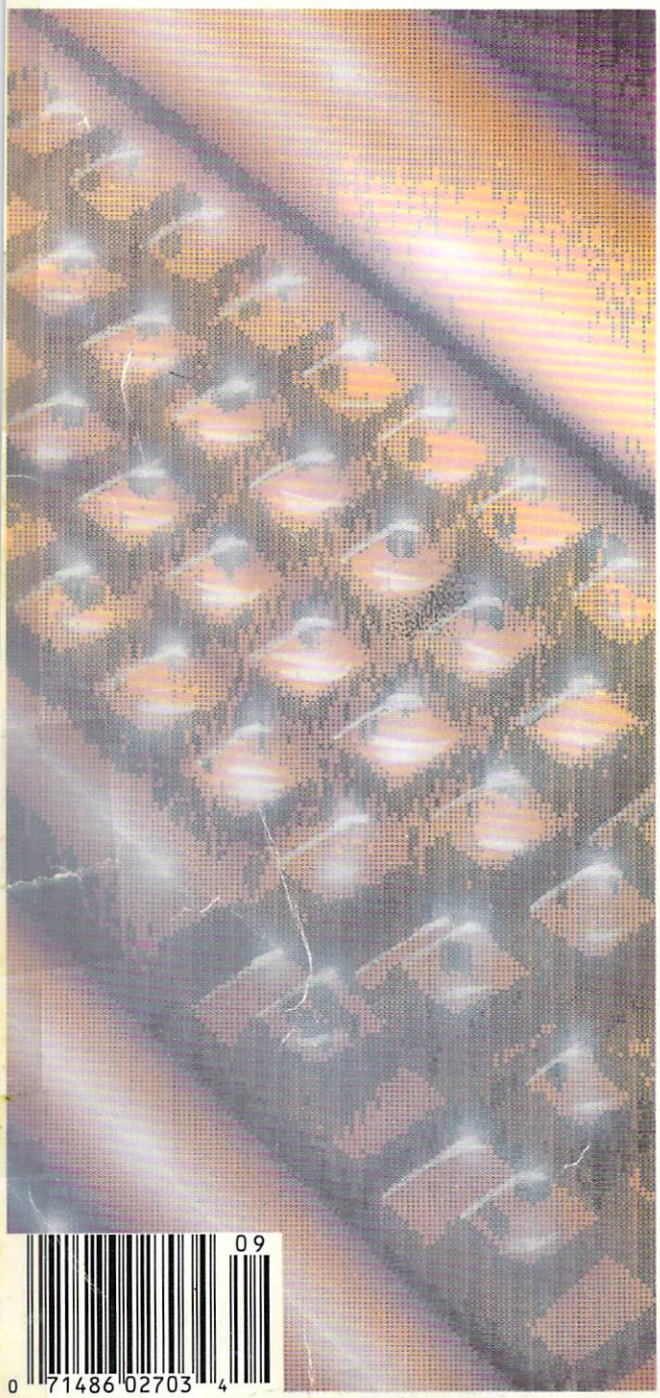
DISK INSIDE

COMPUTE!'s PC magazine

FOR IBM PCs AND COMPATIBLES

$12.95
September 1987
Issue 1
Vol. 1, No. 1

$17.95 Canada
ISSN 0893-8261
02703



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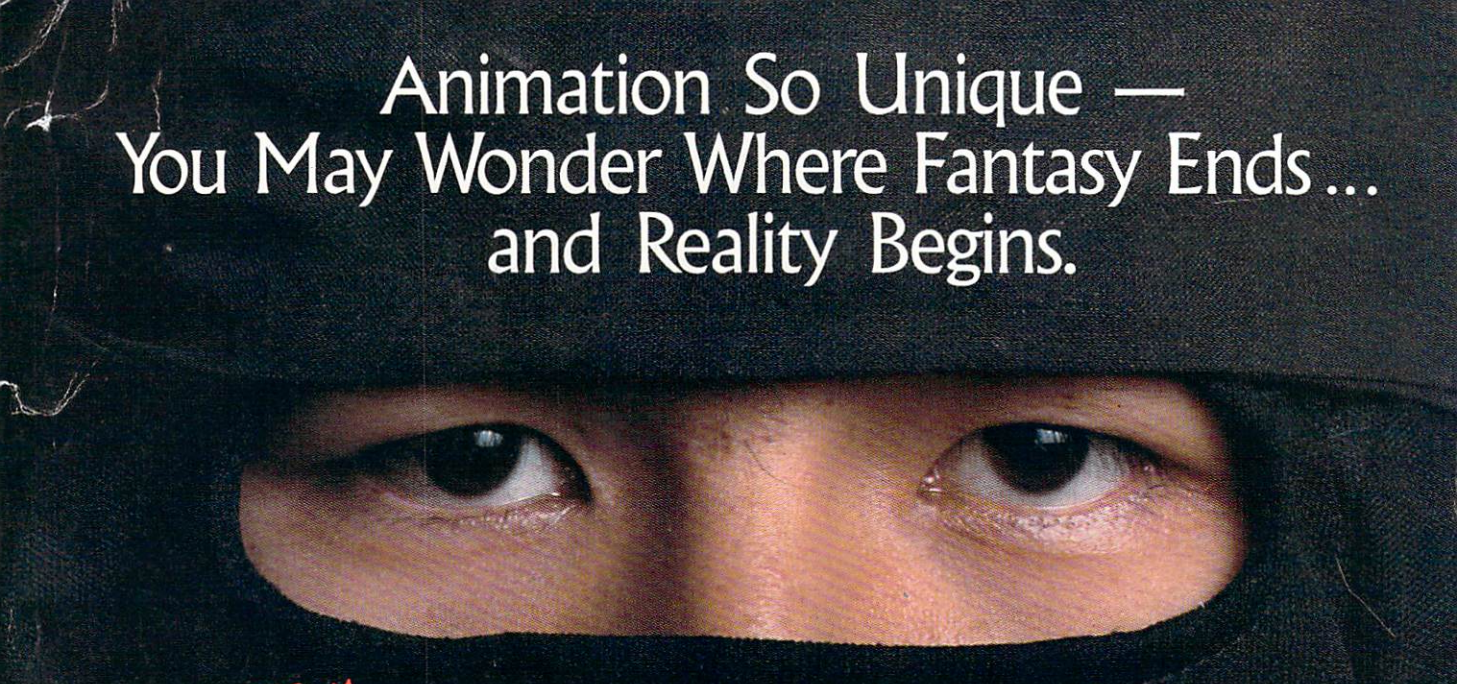

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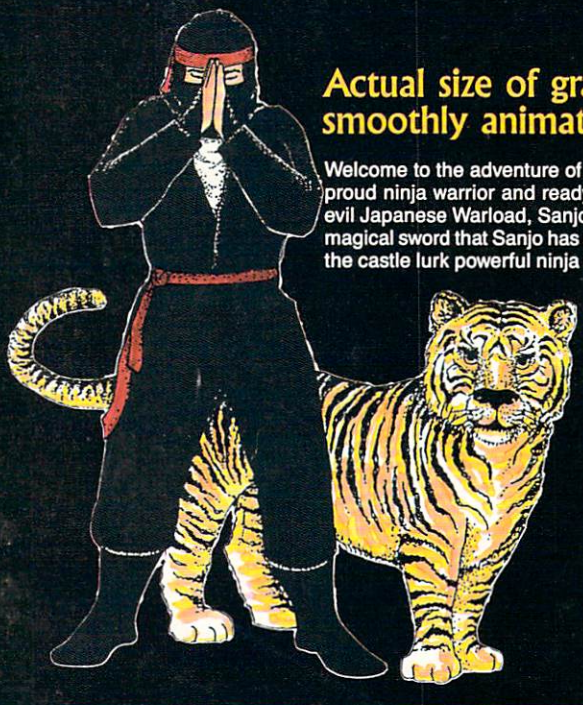

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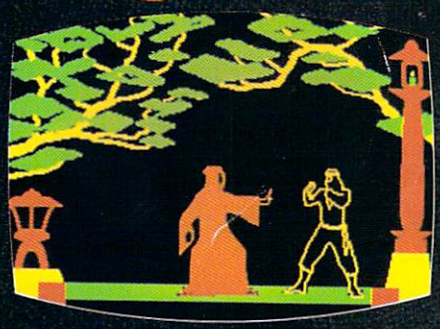

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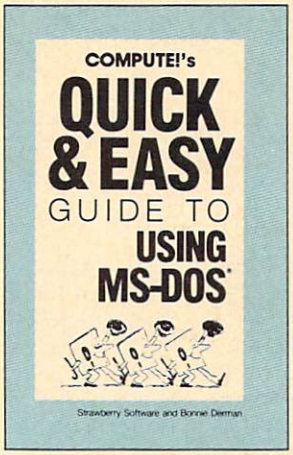

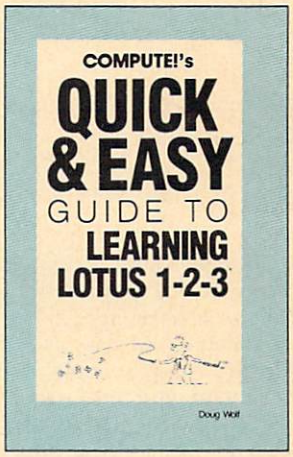

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THE EDITOR'S VIEW

Welcome to the premier issue of COMPUTE!'s PC Magazine. We're embarking on an exciting approach to magazine publishing that hasn't been seen before in the PC-compatible market.

Our approach? We're fulfilling two vital needs shared by all computer users—the need for information *and* the need for software. The most notable difference between COMPUTE!'s PC Magazine and our competitors is that our magazine includes a floppy disk with programs, ready to run on your IBM PC, XT, AT, compatible, or clone. You get programs you can use right now—exceptional, original programs that make your computer more efficient, easier to use, and more entertaining. Programs that are useful at the office or in the home. Programs that don't have to be typed from printed magazine listings. Best of all, you don't have to be a programmer to take advantage of what COMPUTE!'s PC Magazine has to offer.

In this premier issue, for instance, you'll find programs like *Laser Chess*™, an excellent, futuristic, and highly original two-player strategy game. The object is to maneuver various geometric pieces, orienting their mirrored surfaces so you can destroy your opponent's king with a laser beam. It's a perfect example of an animated board game that would be extremely difficult to implement without a computer. *Laser Chess* won the $5,000 First Prize in a programming contest we sponsored last year to help launch a sister publication, COMPUTE!'s Atari ST Disk & Magazine. This all-new PC version of *Laser Chess* is a must for those who enjoy the challenge of a good strategy game.

FreeFiler, a general-purpose database manager, was custom-written for this issue by editorial programmer Tim Midkiff. It has many of the searching, sorting, editing, and printing features you'd expect to find in commercial programs, and it's ideal for tackling small- to medium-sized database tasks. Best of all, you're not limited to prestructured, rigid formats—you create the kinds of records most appropriate to your needs. Compiled in *Turbo Pascal*, *FreeFiler* is also included on the magazine disk, ready to run.

FindDupe is the first program in what will be a regular feature in COMPUTE!'s PC Magazine, our "Best of the Boards" column. All of the other programs in our magazine are original works published here for the first time, but in this column we will present an outstanding example of the software available on electronic bulletin board systems (BBSs). We'll search the country for the finest word processor, the most effective applications, the best games. Most PC users don't have a modem and don't belong to a user group, so they never see most of this software. And even those who have modems find it difficult (and expensive) to sift through the thousands of programs on BBSs, separating the gems from the ore.

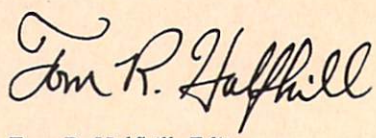
"Best of the Boards" does that digging for you. We pick an outstanding program from the thousands available, track down the author, secure publishing rights to the latest revision, test the program, rework the documentation, and bring you the final polished package. This issue's *FindDupe*, by Karson W. Morrison, is a prime example. It's a very useful program that will help you organize your floppy disks or optimize space on your hard disk. Again, *FindDupe* is included on this issue's magazine disk—just load and run.

Of course, there's more to COMPUTE!'s PC Magazine than a disk. You also get a magazine filled with software and hardware reviews, topical industry news, and feature articles. Plus, there are special columns such as "PC News & Notes," an analytical look at what's happening in the IBM-compatible community; "The Ear," a tongue-in-cheek compendium of industry gossip; "Getting Down To Business," a valuable resource for business people; and "Readers' Feedback," a place where readers and editors can exchange advice.

COMPUTE! Publications, Inc. has been publishing computer magazines since the 1970s, and we recognize that the days when computer users had to be programmers and soldering-gun jockeys are long gone. That's why we've adopted this special magazine/disk format for COMPUTE!'s PC Magazine. It allows us to offer useful articles and programs while sparing you the hours of typing that used to be necessary with printed program listings. Plus, the programs can be far larger, more sophisticated, and written in a wider variety of languages than would otherwise be possible.

If you *are* interested in programming, COMPUTE!'s PC Magazine will also publish programming utilities and tutorials (see "BASIC Cross-Reference" in this issue), and our disk contains the source code for most of our programs. We're also sponsoring a PC Programming Contest with $15,000 in cash prizes to encourage the submission of top-quality, original software. Don't miss the announcement elsewhere in this issue.

COMPUTE!'s PC Magazine is aimed at the millions of people who have bought IBM PCs, mid-priced compatibles, or lower-priced clones over the past few years. If you own a PC, it's likely that you bought it to take work home from the office, or for small-business jobs, or for use as a general-purpose family computer—or all three. But you probably don't want to invest the hundreds of hours it requires to learn a programming language and to write your own software. We hope that a magazine which brings you a diskful of programs every other month—along with features, reviews, columns, and industry news—is just what you're looking for.



Tom R. Halfhill, Editor

"At Mach 3 you don't have time for sightseeing." —Chuck Yeager

You are looking at a breakthrough in flight simulation. Not just a sleepy ride in a Cessna. Or a safe, pretty collection of scenery. But the kind of Mach-speed simulation that makes your palms sweat—and your inner-ear scream for mercy.

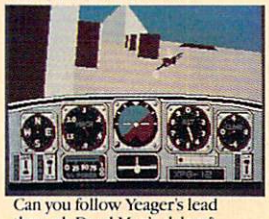
Chuck Yeager co-piloted the entire design. We gave him Mach-speed graphics drivers, state-of-the-art 3-D terrain modeling, and authentic aerodynamics. He added things only Chuck Yeager would think of, like seat-of-the-pants in-air flight instruction, formation flying and even test piloting of 14 different aircraft.

Now you can experience the fun and excitement of flying like never before. Streak along at Yeager's wing—flying formation through gates, slaloms and skyscrapers. Punch a hole in the sky and drive the SR-71 "Blackbird" at full thrust to the very edge of space. Climb into the P-51 "Mustang" and race wide-open, full throttle against six computer-controlled adversaries.

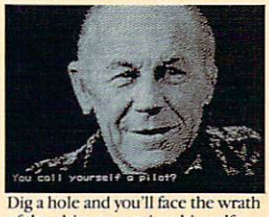
The action is so fast, even experienced pilots can "auger in." Which is why Yeager insisted on windscreen cursors that teach you in mid-flight: from flawless take-offs and flare landings to aileron rolls, Cuban 8's, even Hammerhead stalls.

Program Designer: Ned Lerner. Available for the IBM PC, XT, AT, the Tandy 1000 family of computers, and compatibles. Enhanced performance on the IBM AT, Ram disks, hard drives, and Tandy 3000. Enhanced color support available for Tandy computers and IBM EGA.

Windscreen cursors make learning faster, and a *lot* more fun.



Can you follow Yeager's lead through Dead Man's slalom?



Dig a hole and you'll face the wrath of the ultimate survivor himself.

You can even take on the challenges of a test pilot using Yeager's own evaluation charts. Strap yourself into the Bell X-1 and shatter the sound barrier. Check out Yeager's three supersonic X-jets and enter the "realm of the unknown." Push them too hard and you'll discover the gut-wrenching sensation of hurtling toward Earth at Mach 3.

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COMPUTE!'s PC Magazine is published bimonthly by COMPUTE! Publications, Inc., 825 7th Ave., New York, NY 10019 USA. Phone: (212) 265-8360. Editorial Offices are located at 324 West Wendover Avenue, Greensboro, NC 27408. Domestic Subscriptions: 6 issues, $59.95. POSTMASTER: Send address changes to: **COMPUTE!'s PC Magazine**, P.O. Box 10767, Des Moines, IA 50340. Second class application pending. Entire contents copyright ©1987 by COMPUTE! Publications, Inc. All rights reserved. ISSN 0893-8261.

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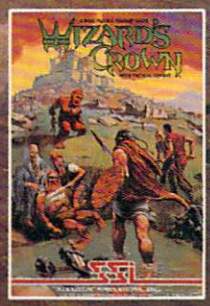

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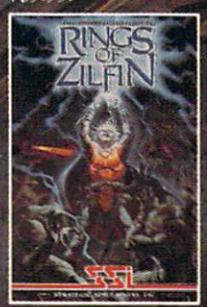

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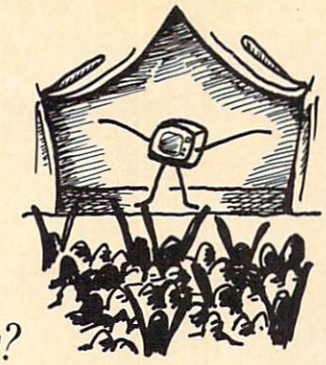

PS/2: What's In It For Us?

Overshadowing the normal deluge of PC-related news last spring was the announcement of the IBM Personal System/2 computers and their new OS/2 operating system. Much has been written about the PS/2 series by business-oriented publications; little has been said about what the PS/2s mean to the home and small-business user.

Are you wondering if your IBM PC, XT, AT, compatible, or clone is obsolete? Is it time to trade in your old trusty machine on a new PS/2 model? Will OS/2 make PC-DOS and MS-DOS a pair of has-beens?

Before the IBM announcement, industry soothsayers predicted that the new IBM line would include several low-cost "clone killers" that would effectively put the numerous manufacturers of compatibles out of business overnight. The experts warned that exclusive proprietary features would be built into the new computers to make them almost impossible to copy. All of the new machines would sport performance that would put the competition to shame, and they would boast graphics capabilities that would be the envy of the entire personal computing industry.

There's an old saying in the computer business: "IBM announcements are always more interesting before they are made."

Actually, few, if any, of the experts' predictions came to pass. An honest appraisal of the cost, compatibility, performance, and graphics capabilities of the PS/2 computers reveals that they fare far better when compared to IBM's previous machines rather than to their present competition. And in fact, that's how IBM introduced the PS/2 series at a lavish media event in Manhattan last April. Numerous price/performance comparisons were drawn between the PS/2s and the original (six-year-old) IBM PC, but the PS/2's real competitors—such as the ubiquitous PC and AT clones, the Compaq 386, the Apple Macintosh, and many others—were not mentioned, even in passing.

No Threat To Clones

If there are any clone killers in the PS/2 line, the rest of the world hasn't seemed to notice them yet. Even after the PS/2 announcement, sales of PC compatibles continued to skyrocket (fueled in part by the shortage of IBM XTs and ATs), and competitors like Compaq continued to prosper in the stock market.

The PS/2s certainly are not price breakthroughs. Shoppers who are expecting the usual 10–15 percent off the price of a complete system may be in for sticker shock when they inquire about the PS/2s. IBM is strongly discouraging discounting in retail outlets. While chatting with a friend who works in the repair department of a major national computer chain, this writer overheard a regional manager berating a salesperson as intensely as a Marine drill instructor chewing out a recruit. The salesperson's misdeed? Knocking 6 percent off a PS/2 Model 50 with a color monitor.

Nor will the speed of the PS/2s leave competing clones in the dust. The performance benchmarks found in IBM's promotional literature can best be termed "optimistic." For instance, when IBM rated the performance of the PS/2 hard drives, it stacked the deck a bit by using a technique called *disk caching*. A disk cache is a portion of memory set aside to speed up disk access. Whenever the computer accesses the disk, it loads extra data into cache memory so it's readily available for a subsequent access. Disk caching is a new feature of the OS/2 operating system, but caching programs for current versions of MS-DOS are extremely common. When the PS/2 computers are rated against PC and AT compatibles with disk caching, the difference in performance narrows considerably.

The PS/2 Model 30, for instance, is no faster that any other 8086-based clone with a turbo mode. In fact, low-end PC AT clones which cost no more than the Model 30 will handily run rings around the IBM machine.

Similarly, the PS/2 Model 50 is more like 1.7 times faster than the original IBM PC AT instead of twice as fast. Granted, the Model 50 is an attractive, compact unit with a fairly reasonable price by IBM standards. However, you don't have the option of buying a Model 50 (or Model 60 or Model 80) without a genuine IBM hard disk so you can install a low-cost, high-performance drive of your choice.

The Model 50 is competing against a wide variety of 12-megahertz AT clones and compatibles that offer superior performance for hundreds of dollars less. If you could soup up a Model 50—add more slots, a beefier power supply, and a faster hard drive—you'd have a PS/2 Model 60. The Model

Arlan R. Levitan &
The Editors

THE EAR

News, rumors, and gossip heard around the PC community.

Trade-War Fallout

Japanese-made AT clones were **conspicuously absent** from the Spring Computer Dealers' Exposition (COMDEX) held recently in Atlanta. Panasonic, Toshiba, and Sharp chose not to display any of the 16-bit machines that were affected by U.S. trade tariffs. NEC did display its Power Mate series of computers—but only while announcing that its entire line will be manufactured in the U.S. **Behind closed doors,** NEC showed insiders a battery-powered laptop AT compatible that will give Toshiba's AC-only 3100 stiff competition. The trade sanctions kept Toshiba from announcing a firm price or availability date for its Model 1200 laptop.

Invading Hordes

Vendex Pacific, a hard-charging Netherlands-based conglomerate, is taking the U.S. market for clones **quite seriously.** The Ear hears that the $7-billion company's initial order from its South Korean manufacturer (Samsung) calls for a shipment of **200,000 units** to the States. The Vendex Turbo 888-XT has an 8088-2 microprocessor that runs at 4.77 or 8 megahertz, a battery-powered clock/calendar, two floppy drives, seven slots, a built-in graphics card that's compatible with the MDA, CGA, and Hercules adapters, a monochrome monitor, and bundled software—complete for $995. All you add is **electricity.**

Feeling The Blues

The **I Wish I Had Said That** award at COMDEX goes to an unidentified attendee who ruffled IBM's feathers. At the center of IBM's mammoth exhibit was a 100-seat theater that was used to stage a bouncy multimedia presentation extolling the virtues of the new PS/2 series. About five minutes into one of the pitches, **a harried voice** rang out from the back of the room: "Excuse me, I'm a very busy man. Can we cut the [expletive deleted] and get to the news?" The questioner was last seen being washed away from the presentation room by a tide of blue suits.

The Me Generation

The **Who's On First** award at COMDEX goes to the company—er, seven companies—which claimed to have the first expansion card for IBM's PS/2 Model 50 and Model 60. And how about an **Honorable Mention** for the firm which claimed to have the first Model 30-compatible card—no mean feat of engineering, since the 30 will take **just about any** XT-compatible board.

Spilling The Bytes

The **Funniest Faux Pas** award at Spring COMDEX goes to a Zenith spokesperson who was answering questions from the press during a luncheon that introduced Zenith's new "under-$1,000-for-everything" EZ PC. Since Microsoft's new *DOS Manager* software for novice PC users is included with the system, Microsoft CEO **Bill Gates** was on hand to speak his thoughts about user interfaces for neophytes. Then someone asked if Zenith had any plans to include **additional software** with the EZ PC. The Zenith representative replied that although nothing is in the immediate offing, it's obvious that *Microsoft Works* would be a natural. At that point, Gates, who had been staring out a window, began **furiously waving his arms.** Either he was **miffed** at the premature announcement of a PC version of the popular Macintosh-based product, or he was trying to wave off a 747 attempting to land on the roof of the Omni International Hotel.

PS/2 Model 30: Really A PCjrjr?

An amusing rumor has been circulating recently: The main system board inside the IBM PS/2 Model 30 is really just a **recycled PCjr system board.** Presumably, this was IBM's way of unloading a warehouse-full of leftover PCjrs. Although the rumor seems absurd, it emanated persistently from about a **half-dozen separate sources.** So we opened up a Model 30 and checked it out—and **it's not true.** The boards are completely different. But we did stumble across something else that was interesting, if not quite as lurid. A quality-control sticker indicates that our Model 30 passed inspection on February 13—**nearly two months before** any of the PS/2 computers were announced to the public.

Whisper To The Ear

*Got something you want to get off your chest? **The Ear wants to hear.** Mail missives to **The Ear,** c/o COMPUTE!'s PC Magazine, P.O. Box 5406, Greensboro, NC 27403. All sources treated confidentially.*

60 can indeed keep up with the 12-megahertz AT clones—but it costs about $2,000 more.

The Model 80 is the top-of-the-line PS/2. It weighs in at nearly 50 pounds, and the price is equally hefty—$7,000 to $11,000. Its performance is on a par with the many 80386 clones that are now appearing for thousands of dollars less.

Good Graphics And Design

In terms of graphics, the PS/2 computers introduced some interesting new color modes, including one that allows 256 colors on the screen simultaneously from a palette of 262,144 hues. Digitized pictures in this mode look almost like freeze-frame images on videocassette recorders. What's more, this mode is available on the least expensive PS/2, the Model 30. Surprisingly, however, IBM omitted the increasingly common Enhanced Graphics Adapter (EGA) from the Model 30.

Even here, though, owners of PC and AT clones aren't left out in the cold. By the end of the year, there should be several graphics adapters which will update PC and AT compatibles to PS/2 standards.

The design and layout of the PS/2 computers is undeniably impressive. A few minutes spent under the hoods of the new machines make it easy to understand how they can be completely assembled in a few minutes on automated assembly lines at the new IBM factories. Everything snaps together crisply without screws, nuts, or bolts, and the usual sprawl of internal cables is tamed. By consolidating the serial and parallel ports, disk-drive controller, and graphics circuitry onto the system board, IBM has achieved a more compact package while reducing manufacturing costs.

However, IBM did not make heavy use of VLSI (Very Large Scale Integration) chips, so the component count is still high. And one disadvantage of the consolidated construction is that service departments not equipped for chip-level repairs will probably have to replace the entire system board if problems develop—an operation not for the faint-walleted. But IBM is merely following a trend; most personal computers these days are primarily single-board machines.

OS/2: Shades Of Mainframes

Like the PS/2 hardware, the new system software introduces a similar mix of innovation, imitation, power, and price. OS/2 will finally establish a standard desktop-style user interface in the IBM world and break the 640K memory barrier that has fenced in MS-DOS for the last few years. Upward compatibility with MS-DOS applications was retained, and multitasking is just around the corner. All this will come, however, at a considerable cost in dollars and bytes.

OS/2 will sell for $400, and power users will undoubtedly want the extended version that integrates a proprietary database language called SQL (System Query Language) and communications with the PC environment—for only $800.

To run OS/2, you'll need at least two megabytes of memory to retain compatibility with MS-DOS software and at least three megabytes to handle the extended version. OS/2 is actually bigger than many mainframe operating systems of the past.

Planned Nonobsolescence

Now that the dust has settled, it's possible to examine the IBM announcements in perspective and draw some conclusions:

- Today's PC, XT, and AT compatibles were not rendered instantly obsolete. Even the PS/2's most interesting features—such as the new graphics modes—will not receive widespread support from software developers before compatible graphics adapters are readily available.
- By keeping its prices relatively high, IBM has not invaded the market now dominated by low-end clone manufacturers. If dozens of these manufacturers start going out of business, it will probably be due to competition among themselves rather than to competition with IBM.
- IBM will most likely concentrate on selling large numbers of PS/2 systems to Fortune 500 companies that want to integrate their personal computers and mainframes.
- The IBM-compatible community will split along MS-DOS and OS/2 lines. OS/2 may be favored by corporations who can afford a large operating system and the memory it requires. MS-DOS—which has certainly not stopped evolving—will probably remain the operating system of choice for the majority of home and small-business users.

As thousands of owners of PCs, XTs, ATs, and compatibles have already concluded, there's no compelling reason to rush out and scrap the old reliable for a new PS/2. And if you're in the market for a new computer, the PC and AT clones still have as much to offer as ever.

The Name Game

Austin-based Michael Dell, 22, has built a Texas-sized company with his PC's Limited mail-order business. From a standing start in Dell's University of Texas dormitory room barely three years ago, the company has grown past the $69 million annual sales mark, out of the dorm, and into a 110,000-square-foot building.

Now it appears the company has outgrown its name as well. As of June 1, customers will be dealing with the Dell Computer Corporation. Dell feels that the new name will lend a high profile to his already substantial penetration of the Fortune 2000 market. Plus, it solves the problem he faced with this summer's launch of his company in the U.K. It seems that over there, *Limited* really *means* something. **PC**

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Even if your contest entry doesn't win a prize, you will still earn purchase fees if we accept your program for publication.

Interested? If so, read these rules:

1. Entries must be your original work, previously unpublished in any form. All those whose programs are accepted will be required to affirm this in writing.

2. You can submit as many entries as you want, but we cannot consider programs which have been either entered in other contests or submitted for publication elsewhere at the same time.

3. The contest deadline is October 31, 1987. All entries must be received at our offices by this date. Programs submitted after this date will still be considered for publication, but will not be entered in the contest. If we purchase an entry for publication before the deadline, the entry is still eligible to win.

4. Entries are allowed (and encouraged) in virtually all software categories: home and business applications, education, recreation, telecommunications, graphics, sound and music, and utilities.

5. Entries may be written in any programming language—including BASIC, C, machine language, Pascal, and Modula-2—as long as they meet two requirements. First, if you're using a compiled language, the compiled object or runtime code must be a self-standing program that can be run by someone who doesn't own a copy of the language. (Interpreted BASIC is an exception. It can be assumed that nearly everyone owns a copy of BASICA or GW-BASIC.) Second, we must be able to legally distribute the program without incurring licensing fees or other obligations to the maker of the language. If you're not sure whether a certain language qualifies, contact its maker for clarification.

6. Entries must be submitted on 5¼-inch floppy disks. If your program is written in a compiled language, you must submit both the runtime code and all of the source code required to compile the program.

7. Entries must be accompanied by an article which explains how to use the program and what it does. If your program employs any new or unusual techniques that you think will be of interest to other programmers, you can also describe how the program works. (If you feel that writing is not your strong point, please do not hesitate to enter; this is a programming contest and the entries will be judged solely on the basis of the programs submitted.)

8. Submissions which do not win a prize and are not accepted for publication will be returned only if accompanied by a self-addressed, stamped mailer.

9. The staff of COMPUTE! Publications, Inc., will judge the contest, and all decisions regarding contest entries and acceptances will be solely at the discretion of COMPUTE! Publications, Inc. All decisions are final. This includes decisions regarding creativity, similarity among entries, and general suitability.

10. Winners will be announced by COMPUTE! Publications, Inc., in early 1988.

11. This contest is void where prohibited by law. Full-time, part-time, and previous employees of COMPUTE! Publications, Inc. and Capital Cities/American Broadcasting Corporation are ineligible for the contest, but may still submit work for publication at standard rates.

Every contest entry must include this signed form:

I warrant that the program presently entitled _____ is my own original work and that the work has not been submitted for consideration elsewhere, nor has it been previously published in any form. If my work is accepted by you, I understand that your decision as to the selection of winners and awarding of prizes is final and without recourse on my part. Should you select my submission, I understand that I will receive no payments until I sign your standard contract, which includes assignment of the copyright of the program to COMPUTE! Publications, Inc., and that you may use my name and image in promotional materials and other forms. *(If you are under age 18, your parent or legal guardian must sign for you.)*

Signature: _____

Address entries to: PC Programming Contest
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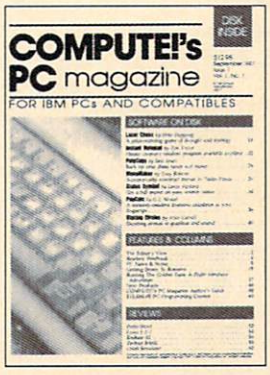

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Do you have a question or problem about hardware or software? Or have you discovered something that could help other PC users? If so, we want to hear from you. Write to PC Feedback, COMPUTE!'s PC Magazine, P.O. Box 5406, Greensboro, NC 27403. We regret that we cannot provide personal replies to technical questions.

[Editor's Note: For this premier issue of COMPUTE!'s PC Magazine, we are responding to questions most commonly asked on bulletin boards and information services.]

High-Speed Drives

What is a RAM drive, what does it do, and where can I buy one?

A RAM drive (also known as a ramdisk or virtual disk) is software which allows you to use part of the computer's memory as if it were a physical disk drive. You can copy files to and from a ramdisk, write to and read from it, run programs from it, and so on. In fact, you can do anything with a ramdisk that you can do with a regular disk except format it or put it in your pocket and walk away after the computer is shut off.

The advantages in using a ramdisk are speed and convenience. An ordinary drive has to do lots of mechanical things to read or write data: start the disk drive spinning, move its read/write head to the correct track on the disk, wait for the proper sector to spin by, and so on. Compared to the speed at which other tasks are performed in a computer, all these things are very time-consuming. A ramdisk is much faster than a floppy drive and even faster than a hard drive because it has no moving mechanical parts. The RAM drive merely simulates a disk drive in memory, so everything happens in a flash within the computer's high-speed memory cells.

There are two disadvantages in using a ramdisk. First, whatever memory you allot to the ramdisk is no longer available for other programs. (Since you can usually specify how much memory will be used for the ramdisk, it should be possible for you to arrive at a size which allows you enough free memory for programs and enough ramdisk space for a specific purpose.) The second drawback is that anything saved or changed on a ramdisk will be lost if the power is shut off. You have to remember to transfer your work to a floppy or hard disk before turning off the computer.

Who needs a ramdisk? Hard-disk users with only one floppy disk drive can simplify the process of copying floppy disks by copying the disk contents to the RAM drive, and then copying the contents of the RAM drive to another floppy. (This is faster and neater than copying the data to and from the hard disk.) For systems with only one floppy drive, software designed for two drives is much easier to use when you set up a ramdisk for the second drive. Frequently used programs (such as a text editor) can be copied to the ramdisk and called very quickly when needed. Compilers, assemblers, and linkers perform their jobs much more quickly when kept in a ramdisk with whatever files they are compiling or assembling. Any software that frequently accesses a drive for information will show vastly improved performance when run from a ramdisk.

Batch files are especially helpful when using a ramdisk. For instance, if you often copy a certain program into the ramdisk when starting up your computer, you can create a special batch file on disk for this purpose. Here's an example:

```
COPY TEXTEDIT.COM D:
```

This copies the file TEXTEDIT.COM from the current disk to the ramdisk, assuming that the ramdisk is installed as drive D. If you include a command like this in the AUTOEXEC.BAT file on your DOS startup disk, the file will be transferred automatically whenever you boot the computer.

To prevent loss of data when you turn off the computer, you can start important programs with batch files that copy the contents of the ramisk to a floppy or hard disk after you exit. For example, the following batch file would start the dBase *database program and then, upon exit, would save all the database files in the ramdisk to a disk in drive A:*

```
dbase
ECHO Insert data disk in drive A:
PAUSE
COPY D:*.DBF A:
```

Another batch file could be used to transfer all of the database files into the ramdisk at the start of the next session:

```
COPY A:*.DBF D:
```

Ramdisk software is included in versions 3.0 and higher of the PC-DOS disk operating system for the IBM PC. The file is called VDISK.SYS and must be installed as part of the system configuration process using the CONFIG.SYS file. See the PC-DOS manual for details. The versions of MS-DOS provided with many IBM-compatible systems also include ramdisk software. The RAM-drive program is called by different names (commonly RAMDISK.SYS), and it is set up in slightly different ways on different computers; see your DOS manual for an explanation of how to install it. The manual should also explain what drive letter will be assigned to the ramdisk. If your version of DOS doesn't include ramdisk software, such programs are widely available in the public domain from user groups and computer bulletin board systems. You may also find ramdisk software provided with the memory expansion boards available from various suppliers.

Keeping Your Feet On The Ground

Here's a tip about the value of keeping your computer plugged into a grounded outlet. My brand-new PC-compatible computer worked fine in the store, but when I took it home, it booted once from the hard drive and then refused to boot again. This meant a trip back to the store, where the lengthy process of reformatting the hard drive and copying DOS to it was performed. Once again, the computer worked fine in the store, but refused to boot more than once at its new home.

Next, another computer was or-

dered. When it came, exactly the same thing happened again. This time, however, the store technician asked me whether or not the power outlets in my house were grounded. They aren't—it's an old house. After an electrician installed a grounded outlet, the computer worked fine, and has continued to do so for a year. Grounding seems to be necessary to prevent things other than electrocution.

Probably more than one elusive hardware bug can be attributed to this cause. Computer designers assume that a ground wire will indeed be grounded. If you're having similarly mysterious problems and you don't know whether your circuits are grounded, call an electrician.

Type Less, Do More

I often find myself having to retype the same things over and over on the computer keyboard. Are there ways to avoid this?

There are various ways to avoid repetitive typing. For example, many programmers (including the authors of DOS and BASIC) have built into their software ways of handling repetitive sequences of commands and keystrokes. These are variously referred to as macros, batch files, or even programs.

BASIC supports one of the simplest yet most effective ways of avoiding the tedious task of retyping commands. Each one of the ten function keys can be defined using the KEY *command. For example:*

```
KEY 1,"LIST 100-200"
```

Adding +CHR$(13) after the closing quotation marks will include a carriage return in the string, so that the command inside the quotation marks will be executed at the touch of the function key. (Otherwise you have to press Enter separately.) By adding a line number, key defintions can be made part of a program. A program consisting of key-definition lines can be saved to disk, loaded, and run at the start of a programming session; this redefines keys easily and quickly.

Unfortunately, you can't assign DOS commands to function keys at the DOS prompt, but some function keys already perform functions for DOS. Pressing F2 repeats the line that was previously typed. F1 does same thing, but does so character by character.

By pressing F1 and judiciously using the Insert and Delete keys, it is possible to correct typos in DOS commands, but this is primitive at best. With DOS, by far the best rule is that if you have to type the same thing more than a few times, let a batch file do it. A batch file is simply a disk file which contains DOS commands. When you load and run the batch file, DOS executes the commands as if you had typed them at the DOS prompt.

Most sophisticated software packages have ways to minimize repetitive typing. The dBase *History feature allows you to repeat up to 20 previously typed commands by using the cursor keys.* dBase *also allows you to use the SET FUNCTION command to define function keys in the same way that BASIC does. The keyboard macros of* Lotus 1-2-3 *are much like batch files. They are merely columns of commands which could be entered singly at the* 1-2-3 *command line. The macro automates their execution, to avoid repetition. See your software manuals for details.*

Hurry Up And Wait

What are wait states, and how do they influence the speed of a computer?

Wait states are short delays deliberately inserted in the computer's instruction execution sequence to slow down the speed of its brain, the microprocessor chip. Microprocessors must work in harmony with other chips in order to communicate with the world around them—memory chips, I/O chips which control the screen display, the printer, disk drives, a modem, and so on. These other chips cannot always keep up when the microprocessor is running at full speed. The microprocessor is ready to go on before the support chips have obeyed the commands that the microprocessor has sent them.

When the memory and support chips used in the computer are slower than the microprocessor, the system's circuitry must be designed to provide one or more wait states during the processor's instruction execution cycle. This slows the processor sufficiently to keep everything in synchronization. Since part of the processor's time is spent executing commands internal to itself (changing the values of its registers, for example) not all of its operations are slowed.

When computers are advertised as having "zero wait states," this means that special, more expensive, RAM memory chips have been installed which can keep up with the microprocessor without the use of wait states. It is estimated that the wait states in an IBM PC AT's instruction execution cycle slow the operation of its 80286 processor by an average of 25 percent. This illustrates the extent of the influence of wait states on the speed of computer operations.

Little Lost Clusters Brought Back To The Fold

I have an XT with a 20-megabyte hard disk drive. When I use the DOS CHKDSK utility, I receive the following message:

```
3 lost clusters found in 1 chains.
Convert lost chains to file? (Y/N)
```

What does this mean? The drive seems to work OK, but every time I use the CHKDSK program I get this message.

It is not uncommon to receive this message from DOS, especially with a hard drive. Fortunately, it usually means nothing.

On a PC or compatible, a cluster *usually consists of two disk sectors. A* sector *is a physical area on the disk which stores a specific amount of data. In the case of the IBM PC, a sector holds 512 bytes (a* byte *is the amount of computer memory which will hold one character, like the letter* A*). Two sectors are grouped together to form a cluster, which is the minimum amount of disk space that the PC uses to store data. (Older versions of the PC, and also the XT and AT, have different cluster arrangements.) Ordinarily, the storage for a file consists of a chain of clusters which come one after another; the length of the chain depends on the file size.*

In day-to-day usage, however, files are added and deleted, or grow and shrink, as information is entered or removed. The more a disk is used, the more scattered the clusters become, because DOS uses the first empty cluster it can find when it has data to put on the disk. Clusters belonging to one file can be found in the middle of the chain of another, or in a distant place on the disk. DOS, of course, keeps track of where these clusters are located so the files are still usable. If you enter the command

```
CHKDSK *.*
```

DOS prints a list of all the files with clusters found in separate places on the disk. If the file is badly fragmented, the drive heads will have to travel a lot from one place to another to read the file; often you can hear this if you listen closely.

Sometimes it's desirable to consolidate a fragmented file so that it can be accessed more quickly, especially if it's on a floppy. (Since hard drives are so fast anyway, fragmentation usually means little loss of disk access time.) The easiest

way to consolidate a fragmented file is to copy it to another disk.

Occasionally, DOS gets confused and loses track of a cluster. The cluster may be marked as used, when in fact it belongs to no program chain. This is the case with the lost clusters reported by CHKDSK. Since CHKDSK asks you a yes/no question ("Convert lost chains to file?"), you might expect that your answer would matter. It doesn't. However you respond, you will still receive the same message the next time you run CHKDSK.

One exception is when you type CHKDSK /F (for Fix). Now your answer does *matter. If you answer no to the same question when it's posed by CHKDSK /F, the lost clusters will be written over and the information they contained, if any, will be gone for good. If you answer yes, the clusters will be made into files named FILE*nnn*.CHK (where* nnn *is a sequential number to keep the files separate). These files can be examined to see whether they contain anything you want to keep. Usually they don't, and it's safe to remove them by answering no to the question.*

Missing Key Codes

In BASIC, I can use the INKEY$ command to trap for ordinary keys like A or 2 with the following program. But I can't use it to trap for special keys like PgUp or PgDn, or the function or cursor keys, because these keys don't have an ASCII value. How can they be trapped?

```
10 A$=INKEY$: IF A$ = "" THEN 10
20 IF A$="1" THEN PRINT "1 key
   pressed"
30 IF A$="2" THEN PRINT "2 key
   pressed"
40 GOTO 10
```

Because ASCII (the American Standard Code for Information Interchange) was designed to be generic, it includes no definitions for computer-specific features such as function and cursor keys. This presents a dilemma for computer designers. On some computers, these keys are assigned ASCII codes and can be trapped like any other key. However, IBM omitted most of these keys from its ASCII character set, probably because it wanted to make room for more graphics characters like the box-drawing and foreign-language characters in addition to the usual alphabetic and numeric characters.

While some keys on the PC do not have an ASCII value, all keys do have a scan code *which can be used to detect when they are pressed. To discover how to access this code, we need to take a brief tour into the facinating, but hidden, world of the PC keyboard.*

The PC keyboard unit is actually a separate computer, with its own microprocessor, RAM, and ROM. The keys themselves are arranged into rows and columns. Circuits inside the keyboard unit are constantly scanning for a keypress. First they pick one row and check every key on that row in sequence, testing for a press. If no keypress is detected, the next row is scanned, and so on. When a keypress is detected, the keyboard uses the row and column numbers to derive the scan code. This code is then sent from the keyboard unit to the computer.

When the computer receives a scan code, it looks in a table in ROM to see if the scan code has a corresponding ASCII character. If a match is found, the character and the scan code are placed in a special area of memory called the keyboard buffer to await use by a program. For those keys or key combinations which have ASCII codes, BASIC's INKEY$ function returns a single character from the keyboard buffer—the one with the corresponding ASCII value.

As you have discovered, the procedure is a bit different for those keys or key combinations which have no corresponding ASCII character. The computer still places two bytes in the keyboard buffer. The first is a 0, to indicate that the key has no corresponding ASCII value—and the second is extended code *for the key (which usually corresponds to the key's scan code). In such cases, the INKEY$ function returns a two-character string. The first character in the string is CHR$(0), the character with an ASCII code of 0, and the second is the character with the ASCII code corresponding to the extended code for the key. For example, if you press the PgUp key, INKEY$ will return a two-character string consisting of CHR$(0) and CHR$(73)—an* I*—because 73 is the extended code for the PgUp key.*

Thus, you can detect the special keys by looking for occasions when INKEY$ returns a two-character string and then checking the value of the second character in the string. Here's one way to modify the example program to look for the PgUp and PgDn keys:

```
10 A$=INKEY$: IF A$ = "" THEN 10
15 IF LEN(A$)=2 THEN 50
20 IF A$="1" THEN PRINT "1 key
   pressed"
30 IF A$="2" THEN PRINT "2 key
   pressed"
40 GOTO 10
50 IF RIGHT$(A$,1)=CHR$(73) THEN
   PRINT "PgUp key pressed"
60 IF RIGHT$(A$,1)=CHR$(81) THEN
   PRINT "PgDn key pressed"
70 GOTO 10
```

The following list shows some of the most common extended codes for special keys. Refer to your BASIC manual for a more complete list:

Key	Extended code	Key	Extended code
Cursor up (↑)	72	F1	59
Cursor left (←)	75	F2	60
Cursor right (→)	77	F3	61
Cursor down (↓)	80	F4	62
Home	71	F5	63
End	79	F6	64
PgUp	73	F7	65
PgDn	81	F8	66
Ins	82	F9	67
Del	83	F10	68

(Note: The function keys, F1–F10, return extended codes only when disabled as soft keys. To turn off the default definition of a function key, use a statement of the form KEYn,"", *where* n *is the number of the function key.)* **PC**

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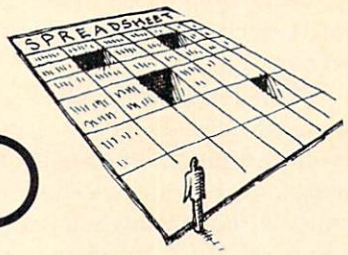

How To Avoid Spreadsheet Pitfalls

Robert A. Moskowitz is a business consultant with more than 16 years of professional writing experience on such topics as business and finance, management, creative problem-solving, energy, travel, investments, and computers. Each issue, his "Getting Down To Business" column will tackle subjects that affect everyone who uses a personal computer for business—whether in a large corporation or a small enterprise run from a home office. Address all comments and inquiries to COMPUTE!'s PC Magazine, P.O. Box 5406, Greensboro, NC 27403.

Recently a construction company won an important contract thanks to an extremely low bid. As usual, of course, the company was expected to perform the work for the price it quoted. Imagine the company's dismay when it discovered that the electronic worksheet used to calculate the winning bid had yielded a figure $250,000 too low.

Upset by this discrepancy, the company filed a lawsuit against the software publisher that sold the spreadsheet program. You may have read about this case in the papers; the lawsuit was unsuccessful when it turned out that the error was traced to the worksheet and was not a bug in the spreadsheet program itself. The people who used the software had inadvertently created the problems causing the damage.

Robert A. Moskowitz

Electronic spreadsheets are one of the most popular applications on personal computers and are largely responsible for bringing computers into thousands of offices throughout the world. Fast, friendly, and powerful, they permit someone who barely understands financial or numerical matters to conduct sophisticated analysis and compute complicated formulas in the wink of an eye.

But, like any powerful tool, when a spreadsheet is used incorrectly or carelessly, it can create monumental problems that could have long-lasting consequences.

By some estimates, errors entered by the user can be found in up to 70 percent of all electronic worksheets. This may be overstated, but even Lotus Development Corp., in its *Lotus* magazine, recently estimated that 30 percent of all worksheets are tainted with unsuspected flaws.

Although few people like to admit that their worksheets may contain errors, tales to the contrary are beginning to circulate anyway. One financial manager, for example, grossly overstated his company's recent earnings because of a simple error in a worksheet. A department head miscalculated raises intended for his employees, and a housewife tried to build a family budget on a worksheet that was not constructed to total some important line items.

Fortunately, human errors in electronic worksheets don't have to remain undetected for very long. There are some simple precautions you can take to minimize errors and defuse these ticking time bombs. The precautions include routine error checks and, sometimes, constructing error-checking formulas within the worksheets to validate their accuracy.

Does It Make Sense?

The simplest method for catching human errors in worksheets is a *reasonability check.* The idea is to see very quickly whether or not the worksheet produces reasonable answers to typical inquiries. You begin a reasonability check by entering fairly small, regular numbers. Do the results *seem* correct? Try doubling, tripling, and halving the numbers, and varying them in other simple, predictable ways. If the answers likewise change in reasonable ways, the worksheet passes this test.

Although the reasonability test sounds simple, it can catch more errors than you may think. Perhaps one of your formulas is written incorrectly or takes values from the wrong cell. Maybe the worksheet contains a value with a misplaced decimal point. These and other errors are difficult to catch by merely examining the worksheet cell by cell.

An even better reasonability test for an electronic worksheet is to check its results against known data. For example, a worksheet that calculates mortgage repayments can be compared against repayment tables or several known mortgage contracts. If the worksheet yields the answer you know to be correct, it is probably valid. If it offers different results, the worksheet warrants further inspection.

A more formal error-checking method is called *cross footing.* Primarily meant to validate accounting or budget-oriented worksheets that

display related sets of numbers in columns and rows, cross footing is the technique of comparing column totals with row totals to make sure they agree. The simplest method is to sum the column totals, sum the corresponding row totals, and then compare the results. If the sums match, the worksheet is probably correct.

In a simple home budget, for example, the total spent across the rows for groceries, take-out food, and restaurant meals should agree with the column total for food. In more complex worksheets, the comparisons must be more selective, and there must be more of them. But the technique still provides an important way to flag mathematical and data entry errors.

One way to simplify checking many cross footing comparisons is to reserve a section of the worksheet for subtracting the corresponding totals. When all the numbers are correct, the reserved section consists entirely of zeros. Any other result sticks out like a sore thumb and is a clear sign of an error.

Auditor On A Disk

More detailed checks for errors are possible with the help of special spreadsheet-auditing software. Many such programs are commercially available, and some spreadsheets—such as Microsoft's *MultiPlan*—now come with built-in auditing features.

An auditing program can quickly perform as many as 50 different checks on a worksheet and can display or print the results. For example, it can pinpoint one of the most common errors in a worksheet: a formula that references just part of a complete range (or group) of cells.

Partial-range references often develop when you build worksheets by trial and error. You may define a range of, say, half a dozen rows containing information on home repair costs, and then refer to that range in a formula that calculates something like home equity. Later, you may add new rows for additional home repair costs. But unless you're careful, those new rows won't be included in the equity formula reference, so the equity figure does not take them into account.

You don't necessarily need spreadsheet-auditing software to avoid this pitfall, of course. One safeguard is to include the title of a range in the formula reference. The title words don't interfere with worksheet calculations, but they leave room for adding new rows within the predefined range, where they are automatically added to any references.

Spreadsheet-auditing software is designed to check all formulas and their references, and to note where a reference does not include all of the cells in a contiguous group. This is not always an error, of course, but the auditing software brings all such cases to your attention and lets you decide if every reference is correct.

Off-Target Copying

Another very common worksheet error occurs when you're copying a formula along a row or column, and you mistakenly replace the formula in one of those cells with a fixed value. For example, users often copy to dozens of cells a simple reference to the previous cell in a row or column. When this is done, changing the value in the first cell immediately changes all the cells. It is also common to copy formulas in worksheets that calculate repetitive transactions, such as mortgage or auto loan repayments.

In either case, the user—mistakenly or not—may replace the formula in one of the cells with a fixed value. If the formula is not restored, the fixed value throws off all subsequent calculations.

Spreadsheet-auditing programs quickly detect and point out errors of this type—where a range of cells containing formulas copied in sequence are interrupted by a single cell with a fixed value.

Two more common errors found in electronic worksheets are *circular* and *reverse references*. A circular reference involves two or more formulas that derive their input values from each other, rather than from fixed numbers typed into the worksheet. Circular references are necessary in some complex calculations, but are more often created by mistake. A related error is the reverse reference, where a formula refers to a cell that is calculated *after* the formula's cell. Either condition can create problems, because each worksheet recalculation produces results based on the previous—not the current—values of the reference cells. In some situations, the formulas never settle down to a final answer.

Spreadsheet auditors automatically identify all circular and reverse references, so the user can correct them if necessary before they lead to problems.

No Substitute For Thinking

Spreadsheet auditors have numerous advantages: They work rapidly, perform many checks, are thorough, and, perhaps most importantly, provide a literal evaluation of what the worksheet actually contains, not what its human creator intended or expects it to contain. But spreadsheet auditors are not the final answer to human errors in electronic worksheets, any more than spell-checking programs are the final answer to typographical errors in documents. No auditing software can identify the most insidious human errors that creep into worksheets: misplaced decimal points, poorly conceived formulas, inaccurate data, and erroneous assumptions.

In many situations, the only way to find these errors is to specifically look for them. For example, there is no substitute for checking, line by line, the input values you entered. Poorly constructed formulas and erroneous assumptions can only be detected by careful, thoughtful analysis. Worksheets that fail reasonability tests and that do not agree with known results should be carefully checked, cell by cell.

A better way, though not

always available, is to ask for help from someone who knows what the worksheet is supposed to do, but has not helped develop it. This is by far the best error-checking method because the person who conceives and develops a worksheet is often, like a proud parent, unable to see its flaws, weaknesses, and errors. The unemotional outsider, however, will often question every assumption in the worksheet, consider other ways to calculate particular values, and generally check all values and formulas. They will sometimes find flaws in the worksheet that the creator might never recognize.

Today's spreadsheet programs and personal computers have become so easy to use and so powerful that electronic worksheets are growing larger and more complex than ever before. This makes them considerably more useful, but it also leaves them more prone to human errors. The danger of these errors will likely never go away, but it can be controlled if you remember that computers are just fast, fancy calculators. It is we, the people who use them, who must be responsible for the accuracy of the numbers we rely on.

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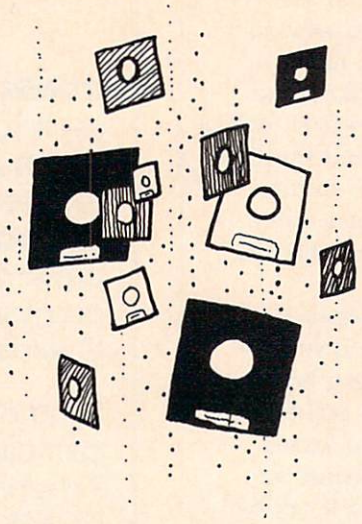

FindDupe

Our "Best of the Boards" column features one outstanding program each issue from bulletin board systems throughout the country. Some of the programs are in the public domain; some are copyrighted by the author but freely distributed; and some are copyrighted "shareware" programs (freely distributed in return for voluntary donations). In each case, COMPUTE!'s PC Magazine obtains the very latest version of the program from the original author in return for a publication fee. We then test the program, rework the documentation, and present the polished package here.

This issue's featured program is FindDupe *by Karson W. Morrison. You'll find it extremely useful to help you organize your software as your collection grows. It works on any PC, XT, AT, or compatible with at least 256K of memory and DOS 2.0 or higher, and with any number of hard or floppy drives. A printer is optional, but recommended.*

If you have a hard disk, sooner or later you have a cluttered hard disk, too. If you don't have a hard disk, you probably have piles of cluttered floppy disks. Inevitably, you're faced with the task of searching for one elusive program in a haystack of millions of bytes. Which program is on which disk?

Karson W. Morrison

And how many duplicate copies of programs are multiplying the problem by wasting disk space?

FindDupe is a handy utility that helps keep your disks organized and weeds out extra copies of programs. It lists programs which are duplicated in more than one directory or on separate disks, and it prints an alphabetical list of the files found on a hard drive or numerous floppy disks.

FindDupe is particularly useful for recovering wasted space on a hard disk. When most people first buy a hard drive, they think it will take forever to fill up the megabytes of storage they just purchased. But before long, they run CHKDSK (a standard DOS utility for analyzing disk usage) and find that a large chunk of the available space is occupied. Where did it all go?

Typically, much of that space is wasted when a file is duplicated in several subdirectories. Text editors, especially, seem to multiply like rabbits and duplicate themselves in nearly every directory or disk used for programming. When you copy floppies to a hard drive, you often transfer a copy of COMMAND.COM (part of DOS) that will never be used. And it's frequently accompanied by CONFIG.SYS and AUTOEXEC.BAT files that can't be used either, because they aren't in the directory from which the computer boots. You can almost always find duplicate files in a stack of floppy disks.

A lot of space is consumed by files which are outdated or no longer used. A complete list of the files on your disks helps you clean house when you compare it to the directory of each disk, taking notice of the date and time stamps.

Using *FindDupe*

FindDupe, written and compiled in *Turbo Pascal*, can be found on this issue's magazine disk under the filename FINDDUPE.COM. It prints complete directories and a list of duplicated files on either the screen or printer, and it also gives you the option of sending the list to a disk file which can later be printed or displayed on the screen. You can print a directory tree which shows every directory and subdirectory, with every file alphabetized in each directory. The date and time, size, and the directory to which each file belongs is shown. *FindDupe* also tells you the file attribute—whether it is a read-only, hidden, system, or subdirectory file.

To run *FindDupe*, just type FINDDUPE at the DOS prompt. It presents the following menu:

```
List only duplicate files on the disk:      (1)
List the entire directory of the disk:      (2)
List both directory and duplicate files:    (3)
List a sorted tree dir of the disk:         (4)
```

Option 1 finds all of the files which are duplicated in more than one directory or on more than one disk. Option 2 lists in alphabetical order all files on multiple floppy disks or a hard drive. Option 3 performs both options 1 and 2. Option 4 prints separate alphabetical listings either for each directory, if you're using a hard disk, or for each disk, if you're using floppies.

After you pick the option you want, *FindDupe* prompts you for the correct drive letter or letters. You may enter several valid drive letters—for instance, A, B, and C—and *FindDupe* will process all files

on those drives.

Next, *FindDupe* asks whether you want to analyze a hard disk or a series of floppy disks. If you specify a floppy drive, you can insert as many disks as necessary into the file that *FindDupe* builds. If a disk lacks a volume name, *FindDupe* lets you enter one without reformatting. If you don't enter a volume name, the default name FLOPPY*nnn* will be entered for you (*nnn* is a three-digit number reflecting the order in which the disk was entered).

When you've finished inserting disks, enter an asterisk (*); you'll be prompted to insert a blank, formatted disk. *FindDupe* uses this disk to store temporary files created during the sorting process, so be sure the disk is empty or nearly so. If you want to direct output to a disk file, *FindDupe* stores the file on this disk.

If you're analyzing a hard drive, *FindDupe* will read all the directories, sort them, and place any output files in the root directory.

Three Output Options

FindDupe will prompt you for the type of output you want: a hard-copy listing on your printer, a screen listing, or a disk file. If you want a disk file, it creates DIRECTRY.DTA for the alphabetical directory and DUPLICAT.DTA for the list of duplicated files. To view these files on the screen, use the DOS TYPE command; to print them, use the DOS PRINT command.

FindDupe can exclude from its list of duplicated files those files which have the same name, but different contents. For example, most commercial software includes a documentation file named READ.ME or README.COM. While these files may have the same name, they don't have the same contents. Also, if you're processing floppies, you probably have AUTOEXEC.BAT and CONFIG.SYS files on many of your disks; you can exclude these from the duplicate listing, too.

To do this, use a text editor or word processor to make a list of the filenames you want to exclude. Each filename should be entered by itself on a line. Save this list with a filename of your choice (such as EXCLUDE.LST). When *FindDupe* asks, *Do you have a file of known duplicates?*, enter this filename.

An alternate way of instructing *FindDupe* to search multiple drives is to include the drive letters on the command line when running *FindDupe*. For example,

```
FINDDUPE ABC
```

tells *FindDupe* to search all directories and subdirectories in drives A, B, and C. Note that you can mix floppy drives and hard drives. All files from all of the drives will be included in the final listing. **PC**

The program FindDupe *is copyrighted 1984, 1985, 1986, and 1987 by Karson W. Morrison.*

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FreeFiler

Tim Midkiff, Editorial Programmer

This flexible application lets you design your own record formats for organizing any kind of information—from an address book to a stamp collection. Written in Turbo Pascal, *it includes high-speed searching and sorting features. It runs on any IBM PC, XT, AT, or compatible with at least 128K of memory and DOS 2.0 or higher. Printer optional but recommended.*

The IBM-compatible community is blessed with some of the best database management software in microcomputerdom. Powerhouse programs like *dBASE, R:BASE,* and others can tackle almost any data-handling task.

But sometimes these programs are *too* big. For somewhat smaller jobs, it's nice to have a general-purpose database program that can be mastered in an hour or two, yet is still powerful, flexible, and easy to use.

That's the goal of "FreeFiler." You won't have to enroll in a course or wade through hundreds of pages of documentation to begin using it—the menus and submenus are fairly self-explanatory, and the finer details can be learned in a short time. But it doesn't skimp on features. FreeFiler lets you create database files limited only by the amount of memory in your computer, and its powerful searching, sorting, and printing functions duplicate the most important features found in all good database managers. You can even design custom record formats to organize nearly any kind of information. And it's fast—FreeFiler was written and compiled with Borland International's *Turbo Pascal.*

You'll find the compiled version of FreeFiler on the magazine disk under the filename FREEFILE-.COM. To run it, simply type FREEFILE at the DOS prompt.

For programmers who are interested in studying how FreeFiler works, we've included the *Turbo Pascal* source code in the file FREEFILE.PAS. If you have a copy of *Turbo Pascal* or another Pascal compiler that's compatible with this source code, you can even modify the program and add your own features.

The Filer Menu

After you run FreeFiler, the first menu you'll encounter is the Filer Menu. Once you exit this menu, you can't return to it without restarting the program. Here are the options:

Create New Database File
Load Existing Database File
Display Disk Directory
Change Disk Path

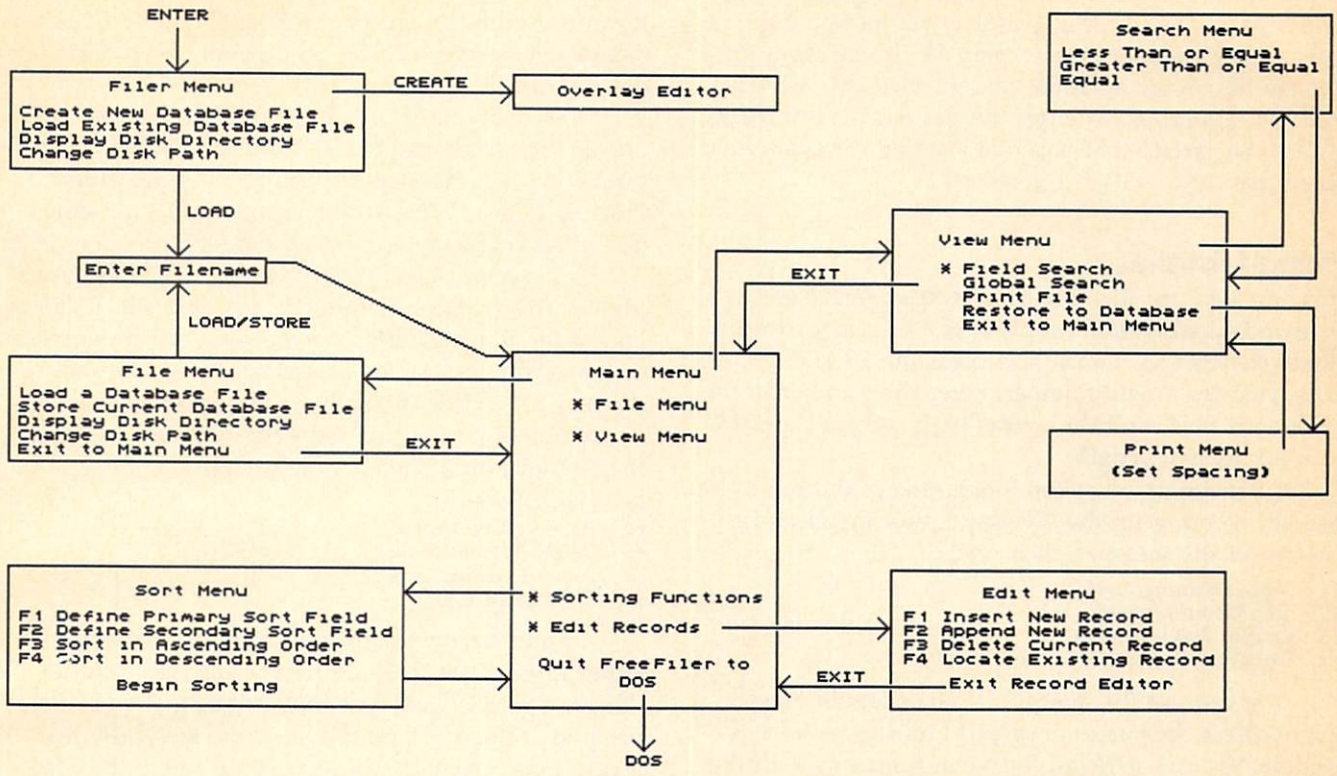
You'll notice that one of the menu commands is highlighted. This feature is common to all menus in FreeFiler. By pressing the cursor up- and down-arrow keys, you can move the highlighted bar to the menu item of your choice, then press the Enter key to make your selection. The cursor keys move the highlight bar *continuously.* In other words, the bar wraps back to the top of the menu if it goes off the bottom, and vice versa.

The most straightforward selection on the Filer Menu is Display Disk Directory. This simply displays a directory of disk files that match the pathname shown at the top of the screen. The default file extension is *.FIL, which shows all filenames on the current drive ending with the extension .FIL (FreeFiler database files).

You can change the pathname mask to display other disk directories by selecting the Change Disk Path option on the Filer Menu. For instance, if you want to see all of the files on drive B, enter B:\ for the disk drive and then *.* for the new filename mask. The Change Disk Path option makes it possible to keep all of your FreeFiler database files in the same subdirectory on a disk. (If you aren't sure how to use pathname masks and subdirectories, see your DOS manual for details.)

The Load Existing Database File option on the Filer Menu allows you to load a previously created

FreeFiler Menu Map



database file. It uses the default pathname unless you specified a new one with the Change Disk Path option. Once the database file is loaded, the Main Menu appears (see below).

If you haven't yet created a FreeFiler database file, this is your first task. Select the Create New Database File option from the Filer Menu. This takes you to the Overlay Editor menu.

The Overlay Editor

With the Overlay Editor, you can design a custom record form for your database file. If you imagine the database file as a collection of index cards, a *record* corresponds to a single card. The Overlay Editor allows you to define the format of the card. The editing window consists of 15 rows of text with 80 characters per row—the maximum dimensions of your card.

Each entry of data within a record is called a *field*. Each field is a place to put a particular type of information—a name, for example, or a zip code. A FreeFiler record can have as few as 2 fields or as many as 15. Once you decide on a record format, all records within that particular file will share the same format.

Each field has an associated *field number*, starting with 0. If you use the maximum 15 fields, therefore, they'll be numbered 0–14. If you want, you can also give the field a name. When you later enter the Edit mode, the field names will be displayed on the screen, so named fields make things easier for the user.

Defining Fields

When defining a field, you must specify its length—the maximum number of characters it can hold. When choosing field lengths, don't specify any more characters than you expect to need—excessively long fields waste memory and disk space. The combined length of all the fields in the record cannot exceed 300 characters.

Defining fields is easy. First, use the cursor keys to move the cursor to the desired position of the field. The Overlay Editor allows you to position fields anywhere inside the editing window. If you want to specify a name for the field, type it in. To mark the beginning of the field, press the F1 key. Then press the space bar (or any letter or number key) once for each character of the desired field length. You will see a series of reversed characters representing the length of the field. (The character used corresponds to the number of the field being defined—0–9 for fields 0–9, or A–E for fields 10–14.) You can press the cursor key (or any other key that doesn't produce an ASCII code) to leave gaps in the field. For example, when setting up a field for a phone number, you might want to leave spaces to add parentheses around the area code and a dash between the prefix and the last four digits. When the field is long enough for your purpose, press the F2 key to mark the end of the field.

If you wish, you can have several fields on one screen line. Just indicate the beginning and end of each with F1 and F2.

Fields are normally defined sequentially, begin-

ning with field 0. For example, after you define field 2, the editor will normally make the next field you define field 3. The Overlay Editor won't let you define a field with a number greater than 14. If you want to change this order for some reason, press the F3 key. You'll be prompted to enter the desired field number (0–14). Be careful that you don't define the same field more than once within the record.

Fixing Mistakes

You can also use this feature to correct mistakes in your record structure. Simply move the cursor to the field you wish to change and press the F3 key. When prompted for a field number, enter the number of the erroneous field, and then redefine it using F1 and F2 to mark its new length.

If you forget what the function keys do, press the Esc key to bring up the Overlay Editor menu at the bottom of the screen, which reads:

F1 Begin Defining Field
F2 Stop Defining Field
F3 Change Field Number
Exit Overlay Editor

You can use this menu like all others in FreeFiler—press the cursor keys and Enter to make a selection. You can perform the same functions with the menu that you do with the function keys—the function keys are just quicker. To turn off the menu, press the Esc key again.

After you've defined all the fields, check once more to make sure you're satisfied with your record structure. The format cannot be changed once you leave the Overlay Editor. It would be unfortunate to enter a large amount of information in your new database and then discover that an important field had been left out.

When you've confirmed that everything is satisfactory, use the Esc key to bring up the Overlay Editor menu. Select the Exit option and press Enter. This sets the record structure and passes you to the Main Menu.

The Main Menu

The Main Menu is where you do most of your business with FreeFiler. From here you take side trips into other menus, and most of the submenus let you return to the Main Menu with an Exit option. Options leading to submenus are marked with an asterisk (*). Here's the Main Menu:

*** File Menu**
*** View Menu**
*** Sorting Functions**
*** Edit Records**
Quit FreeFiler to DOS

If you don't yet have any records in your database file, you should begin by choosing the Edit Records option. This is how you add records to a new or existing database.

The Record Editor

Selecting the Edit Records option moves you to the Record Editor segment of FreeFiler. The Record Editor allows you to add, change, and delete records in your database file.

When you enter the editor, a record will be displayed. You'll see the fields and field names you specified when you defined the record structure with Overlay Editor. Each field is represented by a series of underline characters indicating the length of the field.

Each record has a *record number* which indicates the record's position within the database file. The top line of the Record Editor screen indicates the number of the currently selected record, and it also shows the number of records currently in the database file.

When you press the Esc key, FreeFiler displays the Record Editor Menu, which reads:

F1 Insert New Record
F2 Append New Record
F3 Delete Current Record
F4 Locate Existing Record
Exit Record Editor

To add a new record to a database file, select either Insert New Record or Append New Record. (You can select these functions from the menu or simply press the corresponding function key. *Inserting* a record puts it in the current position within the database file, pushing forward the records which follow it in the file. *Appending* a record attaches it to the end of the database file.

After selecting one of these functions, you can now put information into the record. The data you enter can occupy all of the space reserved for a field, or it can occupy just part of the field. Use the Backspace key to correct typing errors. The left and right cursor keys move about within a field, and the up and down cursor keys move from one field to another. You can also move the cursor from field to field by pressing Enter, Tab, or Shift-Tab. If you move the cursor past the last field in the record, it jumps back to the first field.

When you've finished entering data into a record, press either F1 to insert or F2 to append if you want to enter additional records; you'll be presented with a new blank record to fill. If you're through entering records for now, press Esc to display the Record Editor Menu and select the option labeled Exit Record Editor. This returns you to the Main Menu.

The Record Editor Menu also lets you erase the record displayed on the screen; select the option labeled Delete Current Record (F3 is the shortcut). Use caution, because once a record is deleted, you can't get it back.

If you want to view a certain record in the database and you know its record number, select Locate Existing Record (F4 is the shortcut). You'll be prompted for the record number.

The PgUp and PgDn keys let you flip through records in the database. PgUp moves to the record following the one displayed on the screen; PgDn moves

to the record preceding the one displayed on the screen.

The View Menu

To read records, print records, or search for information in the database, use the View Menu (accessible from the Main Menu), which reads:

* **Field Search**
Global Search
Print File
Restore to Database
Exit to Main Menu

The first two options let you search for certain records in the database. Flipping sequentially through records with the PgUp and PgDn keys as described above is an inefficient way to search for an individual record in a large database, so FreeFiler includes these high-speed search functions. You can search specific fields (a *field search*) in all records, or search all fields in all records (a *global search*).

In a field search, FreeFiler tries to locate the string of characters you're looking for in a specific field of the records. In an address book database, for instance, you can call up a certain person's record by asking for a field search on the name field. FreeFiler won't bother looking for the name in the street address, city, state, zip code, and phone number fields. In a global search, FreeFiler looks for the string in all fields.

To perform a field search, start by selecting that option from the View Menu. Use the cursor keys to place the cursor in the field you want to search. Then type in the string of characters you want to find. You can enter search strings in as many fields as you wish. You can even type in an entire record if you want, and FreeFiler will search for it.

To perform a global search, select that option from the View Menu; you'll be prompted to enter the string of characters you're looking for.

In either type of search, the search string can be the entire contents of a field or just part of a field. However, when seeking a portion of a field in a field search, the *character positions of the strings must match.* For instance, if you perform a field search for *Smith,* FreeFiler will find a match in a record containing the field *Smith, Bill,* as long as the *Smith* portion of the string occupies the first five characters in the field. But it will not find a match with a field containing *Bill Smith.*

In a global search, FreeFiler will match portions of a field whether or not the strings occupy the same character positions within the field. So a global search for *Smith* will turn up a match with a field that contains *Smith, Bill* or *Bill Smith.*

Neither field searches nor global searches are case-sensitive, which means that a search for *Smith* will also find any occurrences of *smith* or *SMITH.*

Examining The Records

If FreeFiler finds a match, it displays the record on the screen. If a match is found in more than one record, FreeFiler makes a temporary list of the records. Press the PgUp and PgDn keys to flip through this temporary list one record at a time. If you watch the top line of the screen that displays the record numbers (*Record 15 of 100,* for example), you may notice that FreeFiler seems to skip a few records when you're paging through the file; it is skipping records which don't contain your search string.

If you perform any further searches at this point, FreeFiler will only search the temporary list of matching records, not the entire database. Similarly, if you select the Print Record option at this point, only records within the temporary list are printed. If you want to dissolve the temporary list, select the Restore to Database option. This doesn't erase any records; it merely discards the temporary list so that a following search or print function will operate on the entire database file.

FreeFiler's temporary lists are useful when reading and printing from large database files. For instance, if you search for *NE* (Nebraska) in a state field, the temporary list will contain only those records with NE in that field. You could print this list for a state-specific mailing. Likewise, if you have an invoice file with a field that denotes whether the order is paid or unpaid, you could search that field for unpaid orders and generate mailing labels for those customers only.

A few special options are available when you ask for a field search. To use these options, press the Esc key after typing in the string you want to search for. The following submenu appears on the screen:

Less Than or Equal
Greater Than or Equal
Equal

You can search for records which contain information that is either alphabetically *equal to, greater than or equal to,* or *less than or equal to* the specified character string. This is particularly useful if the information in the field is numeric—such as dollars and cents. For example, an invoice amount field can be searched for amounts over or the same as a given amount.

Making Hardcopy

The only remaining selection on the View Menu we haven't discussed is Print File. As you might expect, this selection lets you print your entire database file or a subset of the file—the temporary list generated by a search.

When you choose Print File, you'll be asked a number of questions about spacing between records, page length, and so on. This lets you print the list the way you want. For instance, you can adjust the spacing for mailing labels.

The default values are shown in brackets following the questions. If you wish to change any of the

values, simply type in new values and press Enter. Otherwise, skip the question by pressing Enter by itself.

When you're finished with the View Menu, choose the Exit to Main Menu option to return to the central portion of the program.

Sorting With FreeFiler

In addition to all of the functions described above, FreeFiler also lets you sort records by any field in either ascending (A to Z) or descending (Z to A) order. (The default is ascending order.) To access the sort functions, begin by selecting Sorting Functions from the Main Menu.

To sort the records by a field into ascending order, place the cursor in that field and press F1. The field will be filled with 1's, indicating that this is the *primary sort field.* (We'll explain the significance of this in a moment.) If the sorting order is changed to descending, the numbers appear in reverse video.

Now press the Esc key, which will bring up a submenu:

F1 Define Primary Sort Field
F2 Define Secondary Sort Field
F3 Sort in Ascending Order
F4 Sort in Descending Order
Begin Sorting

As you can see, the first option on this submenu is the function you already selected with the F1 key. To initiate the sort, select the last option on this menu—Begin Sorting. FreeFiler displays a message on the screen as sorting proceeds; larger databases naturally take longer to sort. When the sorting is completed, FreeFiler automatically returns you to the Main Menu.

Other options on the submenu shown above let you modify the way FreeFiler sorts a database. To sort from Z to A instead of A to Z, pick the Sort in Descending Order option (or press F4 as a shortcut). To switch back to the default order, pick the Sort in Ascending Order option (or press F3 as a shortcut). The currently selected sorting order is always displayed at the top of the sort screen.

The remaining option on the submenu—Define Secondary Sort Field (F2)—lets you sort up to eight *secondary fields.* For example, it may happen that you have a database with six Joneses in the last name field. Although the last name fields are the same, the first name fields may not be. To sort these records, place the cursor in the *last name field* and press F1, which designates it as the *primary field.* Next, place the cursor in the *first name field* and press F2, which designates this field as a *secondary field.* This will be shown by the 2's which fill the field. When you sort the database, all of the records with *Jones* in the last name field will be arranged sequentially, alphabetized by their first names.

You can define up to eight secondary fields as described above—just move the cursor to the next field and press F2. The order of the secondary fields is indicated by the numbers which will appear: 2's, 3's, 4's, 5's, and so on.

The File Menu

After working with your database, you'll probably want to save the updated version on disk or create a new disk file. These and other functions are available from the File Menu, which is reached from the Main Menu.

Here's the File Menu:

Load a Database File
Store Current Database File
Display Disk Directory
Change Disk Path
Exit to Main Menu

All of these selections are fairly self-explanatory. Display Disk Directory shows what's on the disk, using the pathname mask A: *.FIL. You can change this pathname by selecting the Change Disk Path option. That option also sets the default path for saving and loading database files.

Load a Database File lets you call in a database previously saved on disk. Note that when you load a previously created database file, the previously defined format of that file will become the current record format, replacing whatever record format you were using.

Store Current Database File saves the file currently in memory to disk. (Remember to do this before quitting the program or loading a new database; otherwise, all of your work during the current session will be lost.) When you pick the Store Current Database File option, FreeFiler prompts you for a filename. You'll probably find it convenient to use the filename extender .FIL since FreeFiler displays those files by default when you call a disk directory (for example: ADDRESS.FIL or MAILLIST.FIL.).

Finally, Exit to Main Menu brings you back to the central portion of the program, where you can quit to DOS if you wish. **PC**

Smart Batch Files

Ronald Dorchester

DOS batch files are a quick and easy way to save typing at the system prompt, but there aren't any commands that let you construct menus and get user input as you can in programming languages like BASIC or Pascal. Here's a clever program that gets around this limitation by using DOS error codes. Now you can be presented with a menu of programs to run and tasks to perform each time you switch on your computer. For all IBM PCs, XTs, ATs, and compatibles with DOS 2.0 or higher.

Most people are creatures of habit, and we're no different when using our computers. Usually we switch on the machine and run a certain favorite program, such as a word processor or spreadsheet. Writing an AUTOEXEC.BAT file to run the program automatically after startup is pretty easy (see "Getting Started with Batch Files" elsewhere in this issue). But what if your habits aren't *that* predictable? What if there are several programs or tasks you routinely perform after turning on the computer? Wouldn't it be nice if you could simply choose one option from a menu?

Generally, any command you can type manually at the DOS prompt can be included in a batch file and carried out automatically by the computer. But except for the PAUSE command, which waits for a keystroke before continuing the execution of a batch file, DOS doesn't have any commands for responding to user input. So batch files are automatic and efficient, but dumb.

Fortunately, there's a way to bestow some intelligence on DOS—a special machine language program that runs from a batch file, gets user input from the keyboard, and then returns the response to the batch file for it to use. The program is called CHOOSE.COM.

With CHOOSE.COM, your batch files can display a menu and a prompt such as *Select option 1, 2, or 3 and press Enter*. The batch file waits for a response from the user and then passes the response back to DOS via the batch command IF ERRORLEVEL. In turn, DOS then carries out the option which was selected. Since DOS already has the commands TYPE and ECHO for printing information on the screen, all the materials are at hand for creating smart batch files which can display menu choices and react accordingly.

Getting Started

There are two files on the magazine disk for this article. The first is the main program, CHOOSE.COM. The second is an example of a smart batch file called MENUDEMO.BAT.

To create a smart batch file, call the CHOOSE .COM program in your batch file using this syntax:

CHOOSE ***valid characters/ prompt message***

Note that this will work only if the CHOOSE.COM file is in the same directory as the batch file that calls it, or in one of the directories specified in the most recent PATH command.

The *valid characters* part of the line is the list of characters which can be entered by the user. CHOOSE .COM will sound a beep if any key not in the list is pressed. Valid characters can be any letter, *A–Z* (either upper- or lowercase), or any digit, 1–9. The list of valid characters ends with a slash or a space. The <, >, |, \, and % characters cannot be included in the valid character list because DOS already has special meanings for them. Since CHOOSE.COM recognizes the slash (/) as a separator between the list and the prompt message, you can't use that character in the list, either.

The *prompt message* portion of the statement is an optional line of text which will appear on the screen when CHOOSE.COM is called to accept keyboard input. The prompt starts with the first character after the slash and continues to the end of the line.

Here's an example:

CHOOSE 123/Select option 1, 2, or 3 and press Enter

If you call CHOOSE.COM in a batch file but don't specify any valid input characters, the program accepts only the characters *Y* and *N* (for *yes* and *no*, respectively). If you don't specify a prompt message, the program displays the default prompt *Press Y=Yes or N=No:*.

If you specify a list of valid input characters but no prompt message, the default prompt is *Press Option:*.

Listing The Options

The next few lines after the line with CHOOSE should list the options which correspond to the choices offered the user. Each line begins with the command IF ERRORLEVEL and is followed by the option number, a GOTO command, and then a batch label name. Here's a portion of an example batch file using CHOOSE:

```
ECHO 1) Word processor
ECHO 2) Database manager
ECHO 3) Spreadsheet
CHOOSE 123/Select option 1, 2, or 3 and press Enter
IF ERRORLEVEL 3 GOTO THIRD
IF ERRORLEVEL 2 GOTO SECOND
IF ERRORLEVEL 1 GOTO FIRST
```

When a valid input character (in this example, a 1, 2, or 3) is typed by the user, CHOOSE.COM returns a DOS *errorlevel code* to the batch file. This is simply a number which corresponds to the key that was pressed. Again, referring to the example, here are the errorlevel codes that would be returned by the matching keypresses:

Key pressed:	1	2	3
Errorlevel returned:	1	2	3

Errorlevel codes are assigned sequentially, one for each valid character in the line with the CHOOSE command. The batch file then branches to the line with the matching label name. In the above example, pressing 1 would GOTO the line where the label FIRST is, pressing 2 would GOTO the line where the label SECOND is, and so on.

Here's another example:

```
ECHO A) Run word processor
ECHO B) Run database manager
ECHO C) Run spreadsheet
ECHO D) Display directory of hard disk
ECHO E) Switch to 40-column screen mode
ECHO F) Format floppy disk in drive A
CHOOSE ABCDEF/Select option A, B, C, D, E, or F and press
  Enter
IF ERRORLEVEL 6 GOTO FO
IF ERRORLEVEL 5 GOTO MO
IF ERRORLEVEL 4 GOTO DI
IF ERRORLEVEL 3 GOTO SS
IF ERRORLEVEL 2 GOTO DB
IF ERRORLEVEL 1 GOTO WP
```

For this application, CHOOSE.COM returns the following errorlevel codes in response to the keypresses:

Key pressed:	A	B	C	D	E	F
Errorlevel returned:	1	2	3	4	5	6

CHOOSE.COM then branches to the labels FO, MO, DI, and so on.

It is important to notice in the above examples that the errorlevel codes are arranged in *descending* order—the highest is always listed first. The codes must be arranged this way for the batch file to work correctly. The batch-file statement

IF ERRORLEVEL *value* GOTO *label*

means: "If the errorlevel code is equal to or greater than value, go to the line in the batch file with the specified label." Because the IF command includes an implicit *greater than* test, errorlevel codes must be evaluated from highest to lowest.

As mentioned above, if no list of characters is supplied with the CHOOSE command, CHOOSE .COM assumes that a yes or no question has been asked. It then returns the following errorlevel codes:

Key pressed:	Y	N
Errorlevel returned:	1	0

To finish up a smart batch file, all you need to do is fill in the label names and the names of the programs or DOS commands that the batch file will run. Batch file labels always begin with a colon, and each label can be up to eight characters long. If a longer name is used, only the first eight characters are recognized. Here's an example:

```
:SMARTBATCH
ECHO A) Run word processor
ECHO B) Run spreadsheet
CHOOSE AB/Please select option [A or B]
IF ERRORLEVEL 2 GOTO SS
IF ERRORLEVEL 1 GOTO WP
:SS
SSHEET
GOTO EXIT
:WP
WORDPROC
GOTO EXIT
:EXIT
```

In this example, SSHEET and WORDPROC are commands to load the spreadsheet and word processing programs, respectively. You would replace these with the appropriate commands to load the particular programs you use.

Notice that after the name of the program which the batch file runs there is another GOTO and another label, EXIT. When you have finished with the application program, control is returned to the batch file, which immediately branches to EXIT. This ends the batch file and returns you to DOS. If you replace every occurrence of GOTO EXIT in the above example with GOTO SMARTBATCH, the batch file will rerun itself after you exit the application. In this case, you won't go back to DOS at the end of your application program session; you'll go back to the smart batch file menu.

Batch files allow you to add parameters, if the application program you are running allows parameters. After the command to load your word processor, you can type the name of the document file that you want the word processor to load. For example, if you use *Wordstar*, you could replace WORDPROC with WORDSTAR MYSAGA. The command would load the application program WORDSTAR, and then

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WORDSTAR will load the document file named MYSAGA. If you often use the same file (such as a letter form), this saves even more typing.

A Smart Batch File Demo

We've included a sample smart batch file on the magazine disk for you to examine and run; it's named MENUDEMO.BAT. This file displays a menu and allows you to select several DOS functions. You can easily modify the batch file for your own purposes. Simply replace the DOS functions with your own program filenames, and change the wording of the menu accordingly.

In MENUDEMO.BAT, CHOOSE.COM assigns the A–D keys to DOS functions and the X key to exit the smart batch file. It uses all of the techniques discussed above. Here's a listing of MENUDEMO.BAT:

```
:PROGRAM
ECHO OFF
ECHO
ECHO   A=System Time     C=DIR /w/p     X=Exit to DOS
ECHO   B=System Date     D=Clear Screen
ECHO
CHOOSE XDCBA /↵ Select Option:
IF ERRORLEVEL 5  GOTO TIME-L
IF ERRORLEVEL 4  GOTO DATE-L
IF ERRORLEVEL 3  GOTO DIR-L
IF ERRORLEVEL 2  GOTO CLS-L
IF ERRORLEVEL 1  GOTO EXIT
:TIME-L
TIME
GOTO EXIT
:DATE-L
DATE
GOTO EXIT
:DIR-L
DIR /W/P
GOTO EXIT
:CLS-L
CLS
GOTO EXIT
:
:EXIT
```

Notice that the *highest* errorlevel codes are listed first, and that the corresponding menu-choice letter is the first parameter after CHOOSE. For example, the X which exits to DOS is the lowest errorlevel code, and the first letter found after CHOOSE.

As in the example above, MENUDEMO.BAT exits to DOS when it has performed the selected DOS function. If you replace every appearance of GOTO EXIT with GOTO PROGRAM, the batch file will run itself again, displaying the menu and allowing you to continue to make choices until you pick the Exit to DOS option.

While MENUDEMO.BAT uses the ECHO command to display the menu, you can also use the TYPE command for this purpose. Use a word processor or text editor to make your menu file, and then insert the command TYPE *filename* at the appropriate place in your batch file. Your menu will be loaded and displayed. **PC**

BASIC Cross-Reference

Barbara J. Komiske

Debugging a program is a chore, but the job is easier with this utility. It makes cross-referenced listings of variable names, GOSUBs, GOTOs, and the line numbers where the statements appear. It works on any IBM PC, XT, AT, or compatible with at least 256K of memory, DOS 1.1 or higher, and a printer.

If you're debugging or modifying a complex BASIC program, sometimes it's helpful to have a list of line numbers targeted by GOTO and GOSUB statements; with this you can follow the program's flow and keep track of important subroutines. At other times, you may need a complete list of variables and the lines in which they appear. This can be especially useful for detecting a misspelled variable name, which makes BASIC think that you're intentionally using two different variables. It can also reveal when a variable is being changed by another subroutine without your knowledge.

"BASIC Cross-Reference" is a dual-purpose utility that generates both kinds of lists. Novice and seasoned programmers alike find that such cross-referenced listings are a valuable programming tool. They are useful for documentation, too.

Analyzing A Program

BASIC Cross-Reference is easy to use. You'll find it on the magazine disk under the filename CROSSREF.EXE. For optimum performance, the utility was compiled with Borland's *Turbo BASIC*. If you're interested in studying how it works, you'll find the original BASIC program as an ASCII source code file on the magazine disk under the filename CROSSREF.ASC. You can read it with the Edlin program (one of the DOS utilities that comes with your machine) or use any word processor.

Before running BASIC Cross-Reference, make sure the BASIC program you want to analyze is also saved on disk in ASCII format. To do this from within IBM BASIC or GW-BASIC, simply type SAVE *"FILENAME.ASC"*,A (substituting your own filename, of course). This saves the program on disk as an ASCII text file.

To run BASIC Cross-Reference, type CROSSREF at the DOS prompt. The utility will ask you for the drive, path, and filename of the program to be cross-referenced. (Remember to enter the name of the ASCII file, not the BASIC program file.)

Next, you'll see the following menu:

```
1. Cross Reference of Branches
2. Cross Reference of Variables
3. Both Branches and Variables
Your Choice:
```

Select the number of the option you want and press Enter. The utility displays the current line number being processed to inform you of its progress. BASIC Cross-Reference is swift. It will analyze a program several hundred lines long in less than a minute.

When the utility is done processing each line and sorting the references, it beeps to let you know it's time to set up the printer. Press any key to generate the listing.

Special Notes

BASIC Cross-Reference has a few limitations, but they're rarely significant.

First, it allows a line length of only 254 characters in the program it's analyzing instead of the 255 allowed by BASIC. If a program line contains 255 characters, an overflow error results.

IBM BASIC and GW-BASIC accept variable names of any length and recognize the first 40 characters as significant; BASIC Cross-Reference recognizes only the first 15 characters of a variable name. This means that if you use very long variable names and two or more of your variables begin with the same 15 characters, BASIC Cross-Reference cannot distinguish between them.

While ALL, APPEND, BASE, and OUTPUT are acceptable variable names, they are more frequently used as BASIC keywords. This would confuse the cross-reference program, so if you use these words as variables, they won't appear in the variable listing.

BASIC Cross-Reference considers as branches all line references that are affected by the RENUM command. User-defined functions are treated as variables. Variable-type specifiers (such as % for integer variables) are not printed in the listing, and neither is the ampersand (&) which signifies hexadecimal numbers.

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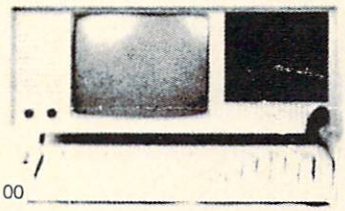

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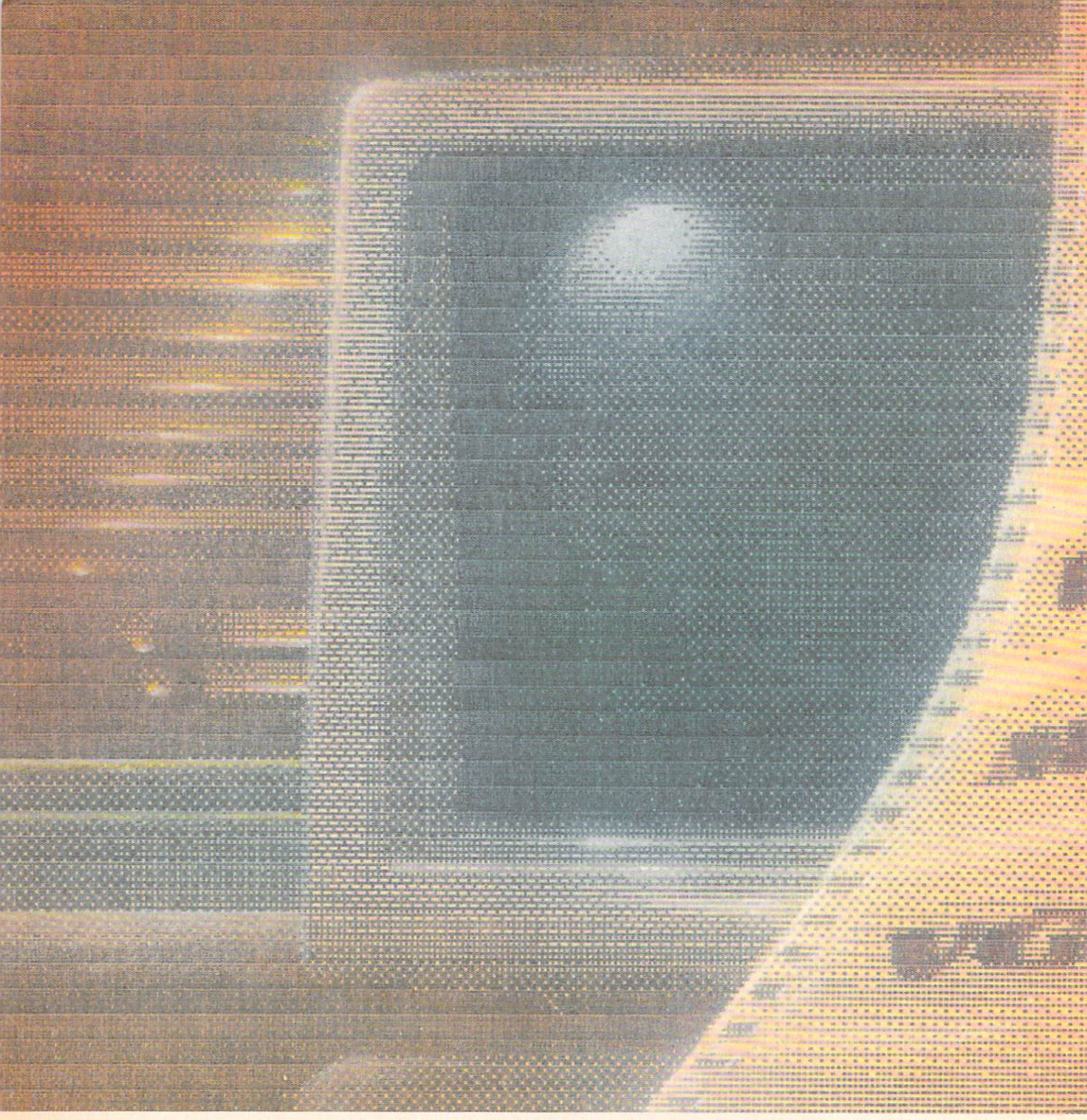
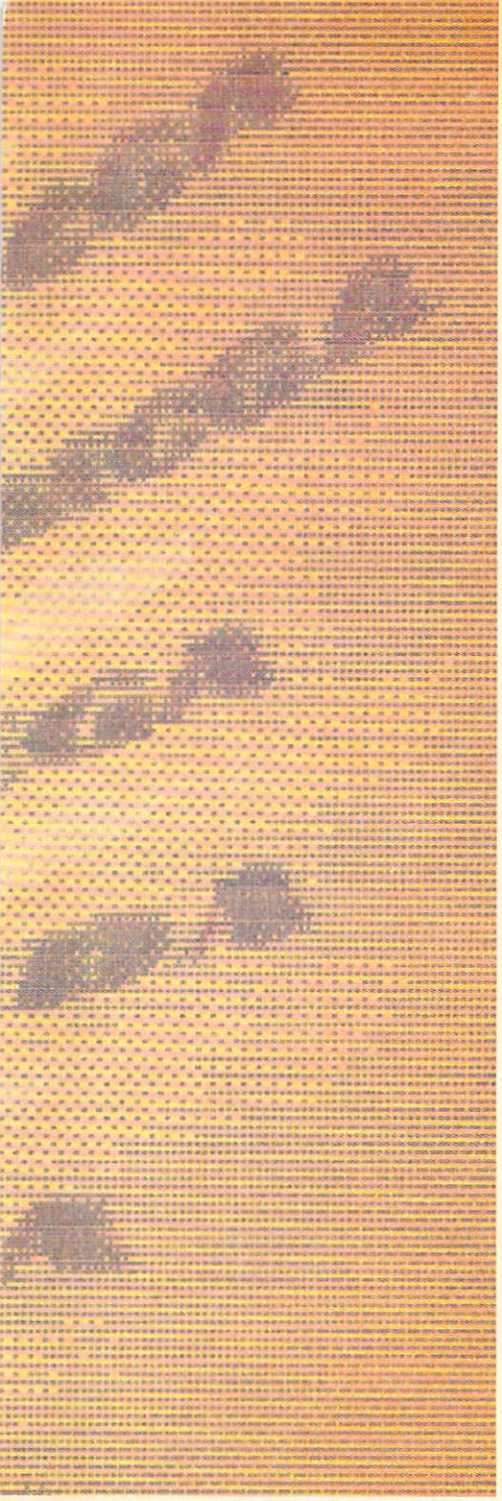


Choosing A Display Standard

George Campbell *What's the most important peripheral in a personal computer system? If the disk drive, printer, or modem are the first devices that come to mind, think again. Your video monitor gets the most use by far—virtually every minute you work with the computer is spent staring at the screen. That's why the display standard you choose is so crucial. But with cryptic terms like MDA, HGC, CGA, EGA, MCGA, and VGA to sift through, it's no wonder so many PC users have trouble figuring out which display adapter to buy. Here's a guide to all of the common display standards and how to determine which is best for you.*



Whether you're buying a new PC or thinking about upgrading your present system, no choice you make is more important than choosing the right display adapter and video monitor. If you make the wrong choice, you'll soon be shopping for replacements, adding unnecessary expense to your computer investment.

The *display adapter* or *display standard* is simply the circuitry inside your PC that generates the image you see on the monitor screen. The type of display adapter determines the type of display you see: monochrome or color, low resolution or high resolution. Of course, the display adapter and video monitor must work together. A monochrome display adapter, for example, can't display a color screen, even when a color monitor is connected.

The *resolution* of the adapter/monitor combination is a measure of the amount of detail that can be shown on the screen. This, in turn, determines the readability of text and the flexibility of graphics. Resolution is most often expressed in terms of screen dots, or *pixels* (picture elements). The greater the resolution, the finer the detail. Again, the adapter and monitor must complement each other; a low-resolution display adapter can't generate a high-resolution screen, even with a high-resolution monitor.

The original IBM PC was essentially an empty box that came with no display adapter at all. One of the first decisions a buyer faced was which adapter board to buy—monochrome or color. And that decision, in turn, determined which monitor was required.

Today, most PC compatibles come with at least one display adapter built onto the computer's main circuit board *(motherboard)*. You don't have to buy an adapter to get started, and you don't have to waste a valuable expansion slot on an adapter card. But the display adapter built into your computer may not be the best one for your needs.

There are four popular display standards for PC-compatible computers, and recently IBM announced two new standards for its Personal System/2 line, thereby adding to the confusion. With so many options in wide use, even the term "display standard" becomes a bit misleading. How do you decide which road to take?

Consider Compatibility

There's an old saying in the PC community: "Let your software dictate your hardware choices." Nowhere is that more important than in choosing a display standard. Before making a decision, assess your software needs. Consider not only the software you currently use, but also any software you may want to use in the future. After making these decisions, you can safely select a display standard that will perfectly fit your requirements.

Even when you've settled on a display standard, however, the dilemma continues. For each standard there are a number of different video cards and monitors to choose from, made by a wide range of companies. Choosing between them can be difficult.

Once again, compatibility should be your guideline. Check with dealers, manufacturers, or distributors to make sure your choices are compatible with both your hardware and software. If at all possible, see the video card and monitor in operation together. Try your software on the combination.

Of course, if you purchase your adapter and monitor by mail, this won't be possible. Try checking with friends, colleagues, and your local IBM user group to see if anyone has already installed the combination you're considering. If you can't find anybody with a similar setup, make sure the mail-order company will accept returns if the equipment doesn't prove compatible.

Price is a major consideration for most people, and you'll find that there's a wide price range for every display standard. Generic display adapters and monitors have attractive prices, but you may experience problems with compatibility and reliability. Think carefully before buying the least expensive equipment.

With these considerations in mind, let's take a look at the display standards that are available for

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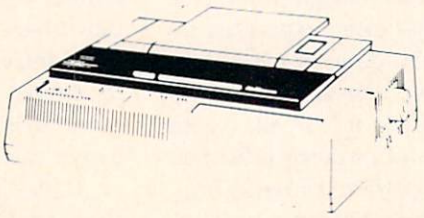

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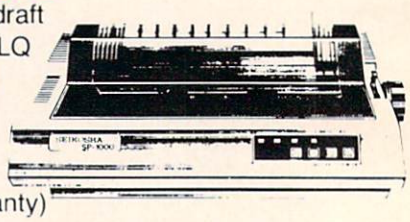

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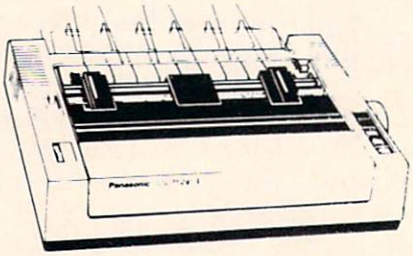

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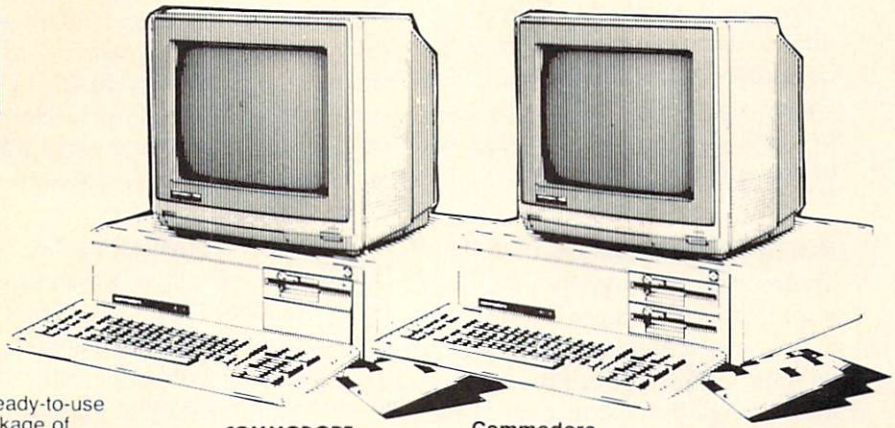

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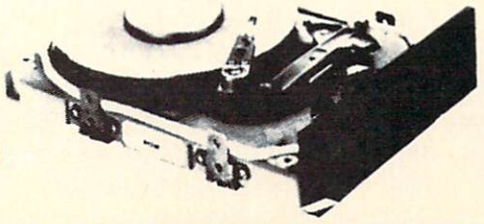

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Monochrome Display Adapter

When IBM introduced the original PC in 1981, it decided that most people would use the computer for business applications which required no graphics capabilities. The monochrome display adapter (MDA) was designed to fill that need.

As a result, the MDA offers a high-quality text display with very limited, character-type graphics. The screen resolution is 720 pixels per horizontal line by 350 pixels per vertical column (expressed as 720 × 350). Since the MDA allows 80 characters per line and 25 lines per screen, each character is composed of a box that's 9 × 14 pixels (720/80=9 and 350/25=14).

A 9 × 14 character grid is considered very good, and when coupled with a high-quality monochrome monitor, the MDA's text display is very readable. This makes the MDA an excellent choice if your applications are all text-oriented and you have no need for graphics or color.

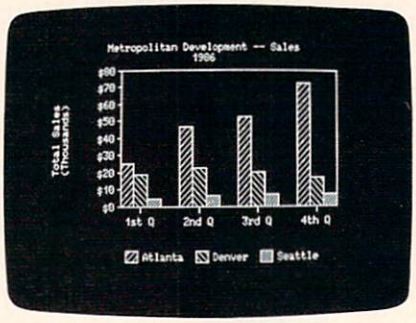
IBM's original monochrome display adapter (MDA) provides very readable text, but no true graphics or color capabilities.

Many new users choose this standard because they feel, at first, that they'll only use their computer for word processing and data base applications. However, quite a few end up adding another display adapter so they can run software that requires graphics.

With the MDA comes a choice of monitors. Both green and amber monitors are available at about the same price. Some people say that amber screens are easier on the eyes in offices with bright fluorescent lights, and that green screens are better in areas illuminated with dimmer tungsten lights. Others claim the reverse. Make your choice after seeing both in the type of lighting where the computer will be installed.

Hercules Graphics Card

The only widely accepted standard not initially introduced by IBM, the Hercules graphics card (HGC) and its imitators offer a combination of the high-quality text display of the MDA plus high-resolution monochrome graphics.



The Hercules Graphics Card (HGC) provides a text display that rivals the MDA, but offers monochrome graphics as well.

Using a green or amber monochrome monitor and compatible software, the HGC provides a resolution of 720 × 348 pixels, greater than most other display adapters and roughly the same as the MDA. Like the MDA, the HGC offers a 9 × 14 character grid for highly readable text. But unlike the MDA, it also offers true graphics for displaying charts, graphs, and pictures—albeit in monochrome.

There is a catch, however. Not all software supports the HGC standard. Most business, computer-aided design (CAD), and desktop publishing software will work with the HGC, but many other programs cannot. Games, in particular, often do not support this standard. If you do your own programming, you should be aware that IBM BASIC doesn't support HGC graphics, either. Check your software for compatibility.

If you don't need color, but you do need high-resolution graphics, you should seriously consider the HGC. Many PC clones and compatibles offer this standard—often calling it *monographics*—as the normal display mode. However, some copies of the genuine Hercules Graphics Card have compatibility problems. Try your software to make sure.

Recently, Hercules has introduced two new video boards based on the original HGC. They offer increased speed with some applications, and one even adds color. But many programs do not support all the features of these new boards.

Color Graphics Adapter

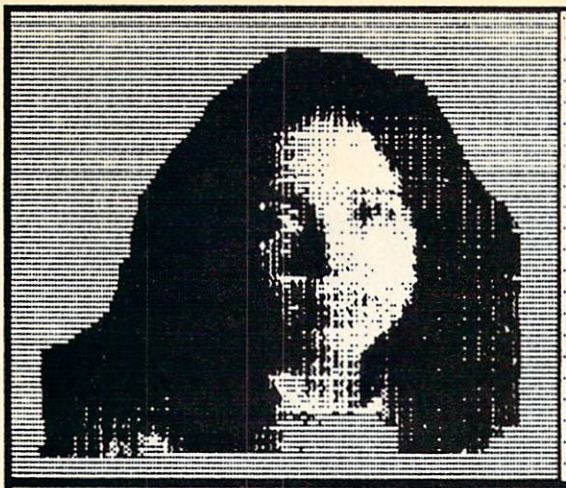
As soon as the IBM PC appeared, it became obvious that some sort of color graphics capability was essential. IBM's answer was the color/graphics adapter (CGA). Combined with an RGB (red-green-blue) color monitor, it offers both text and graphics in color. The maximum resolution is 640 × 200 pixels with two colors. A lower-resolution mode of 320 × 200 pixels can display four colors at a time. In all, there are 16 different colors to choose from—or to be more exact, eight different colors available in two luminances each.

The CGA has two text modes: 80 columns with 25 lines, and 40 columns with 25 lines. The character grids for these two modes are 8 × 8 pixels.

This standard is perhaps the most widespread of all the PC display standards. Since there are millions of CGA-equipped systems, almost all software is compatible with this standard.

If you need color graphics, a CGA board and color monitor is the lowest-priced system available. Thanks to the large number of CGA systems in use, new software will continue to support the CGA standard for some time.

There are drawbacks to the



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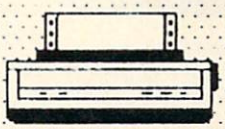

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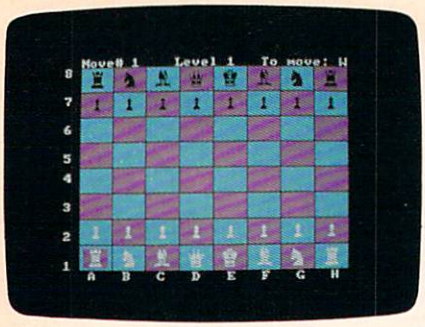


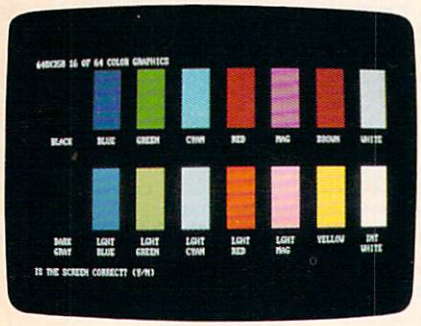
IBM's original color graphics adapter (CGA) has true graphics and a palette of 16 colors, but the 80-column text mode is less readable than with a monochrome adapter.

CGA, however. The text display provided by the 8 × 8 character grid is far less readable than MDA or HGC text. Many users find CGA text to be fatiguing after long periods at the screen.

Also, the graphics resolution of the CGA standard—while sufficient for most applications—can be too coarse for intensive tasks such as CAD and desktop publishing.

Enhanced Graphics Adapter

Recognizing the need for increased graphics resolution required by some applications, IBM introduced the enhanced graphics adapter (EGA) in late 1984. Along with the previously available screen modes, it offers a 640 × 350 graphics mode with up to 16 simultaneous colors.



The enhanced graphics adapter (EGA) offers a good combination of color graphics and readable text—but at a higher price.

On top of that, the EGA's 80-column by 25-line text mode uses a character grid of 8 × 14 pixels, almost equal to the original MDA text mode. Most users find EGA text easy on the eyes.

Software companies have quickly added EGA compatibility to their programs. Most older software, designed for either the MDA or CGA standards, runs on EGA systems with no problems.

Naturally, the increased resolution of the EGA comes at a higher price. The display adapter card itself is more expensive, and EGA-compatible monitors cost more as well. The ordinary RGB color monitors used with the CGA do not work with the EGA.

When IBM first introduced the EGA, the card cost $985 with 256K of display memory, and the special monitor cost $700. Today, however, copies of IBM's EGA card have forced prices below $200, and EGA monitors have begun to come down as well.

If you're upgrading your present system, it's possible to buy the components one at a time, keeping your system running as you save for the next component. Many of the new EGA-compatible cards even support monochrome monitors and the HGC standard. The latest monitors, equipped with multiple synchronization rates, can also adapt to older cards, making upgrades easy, if not inexpensive.

New Display Standards

Six years after the introduction of the original PC, IBM has followed up with its new Personal System/2 computers. Graphics standards were a natural area for improvements, and IBM did not disappoint us. It introduced two new graphics standards, both with increased resolution and more colors.

The first standard, the multicolor graphics array (MCGA), is available only on the lowest-priced computer in the PS/2 line, the Model 30. It is standard equipment on that computer. It offers all of the old CGA modes; a new 640 × 480-pixel graphics mode which can display two colors simultaneously from a palette of 262,144 possible hues; and a mode that's 320 × 200 pixels and that can display 256 colors simultaneously, out of 262,144 possible colors. The latter mode is capable of displaying pictures that look almost as good as freeze-frame images on a videocassette recorder.

Inside the System Unit
The system unit is the central part of your system. It contains the microprocessor, memory, and disk drives.

Although the resolution of this multicolor graphics adapter (MCGA) screen is only 320 × 200 pixels, it approaches videotape quality.

The other new standard, the video graphics array (VGA), is the normal display adapter for the Models 50, 60, and 80 computers in the PS/2 line. A VGA card is available for the Model 30 as well as for the original PC series. It increases the number of colors that can be displayed simultaneously in the 640 × 200, 640 × 350, and 640 × 480 modes to 16 from a palette of 262,144. This is a dramatic increase in both resolution and color capabilities. Both systems offer a 9 × 16 character block in text mode—even better than the MDA.

The video graphics array (VGA) is standard on the higher-end IBM PS/2 computers, but is available as a plug-in card for the PS/2 Model 30 and regular PC compatibles.

Naturally, the new display standards require a new type of monitor. Since the old digital RGB monitors couldn't display more than 16 colors, IBM has shifted to analog RGB displays for all of the

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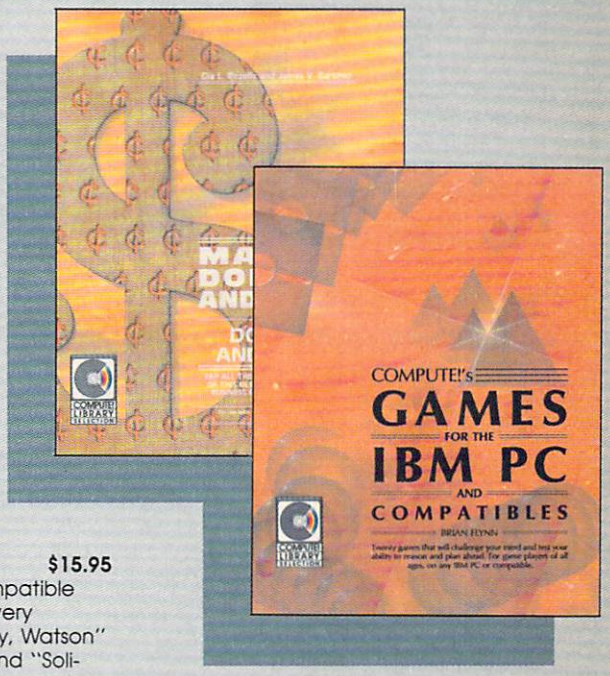

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Table 1: IBM-Compatible Display Standards

Adapter	Monitor Type	Compatibility	Price Range with Monitor
MDA	TTL monochrome	PC, XT, AT, clones	$150–$500
HGC	TTL monochrome	PC, XT, AT, clones	$150–$500
CGA	RGB color/composite monochrome	PC, XT, AT, clones	$400–$700
EGA	EGA color/multisync color	PC, XT, AT, clones	$600–$1000+
MCGA	Analog monochrome/analog RGB	IBM PS/2 Model 30	$250–$1550*
VGA	Analog monochrome/analog RGB	PC, XT, AT, clones**, IBM PS/2 Models 30, 50, 60, 80	$250–$3000***

*MCGA is standard on Model 30. Price is for monitor only.
**VGA compatibility with clones may vary with manufacturer.
***Price depends on model. VGA is standard on Models 50, 60, and 80, but extra on Model 30. See article.

Table 2: Display Adapter Text Modes

Adapter	40 × 25	80 × 25	Character Grid	Simultaneous Colors/Palette
MDA	No	Yes	9 × 14	Mono
HGC	No	Yes	9 × 14	Mono
CGA	Yes	Yes	8 × 8	16/16
EGA	Yes	Yes	8 × 14	16/64
MCGA	Yes	Yes	9 × 16	16/262,144
VGA	Yes	Yes	9 × 16	16/262,144

Table 3: Display Adapter Graphics Modes (Simultaneous Colors/Palette)

Adapter	320 × 200	640 × 200	640 × 350	640 × 480	720 × 348
MDA	No	No	No	No	No
HGC	No	No	No	No	Mono
CGA	4/16	2/16	No	No	No
EGA	16/64	16/64	16/64	No	*
MCGA	256/262,144	2/262,144	No	2/262,144	No
VGA	256/262,144	16/262,144	16/262,144	16/262,144	No

*Some EGA-compatible cards emulate HGC.

PS/2 computers and for the VGA adapter. There is a monochrome monitor, which represents colors in shades of gray, and three color monitors, with prices ranging from $250 for the monochrome monitor to $1550 for the 16-inch color monitor.

Finally, by adding an additional card to the VGA system in PS/2 computers, you can have a 1024 × 768 pixel, 16-color graphics mode and increase the number of colors in other modes. The cost for this high-end system is $3,100, not including the PS/2 computer.

So far, very little software is available which takes advantage of these new display standards, but new programs should be emerging soon. In the meantime, the new standards will run most software written for the old standards. IBM warns, however, that there may be some compatibility problems with software which directly addresses screen memory.

Other Display Systems

There are still more display adapters and monitors to choose from, designed for specific applications. Some offer higher resolution, more colors, or have features not provided by IBM-compatible display standards.

Most of these systems were designed for CAD and desktop publishing applications rather than for everyday computing. Few programs support these specialized displays, so they cannot be considered standards.

Compaq and Kaypro PC-compatible computers come with a display adapter which can display CGA graphics on a monochrome screen. Cards are available from Everex and other manufacturers which perform a similar function. These offer another choice for the budget-minded PC owner.

There is an almost linear progression in the price of display systems. The more colors and the greater the resolution, the higher the price. By choosing a display system for your PC that offers just the capabilities you need now and anticipate needing in the future, you won't pay for features you're unlikely to use.

Given the rapid changes taking place in the PC world, by the time you need to upgrade from the display system you choose now, even more powerful standards will have emerged. **PC**

Laser Chess™

Mike Duppong
PC Version By Tim Midkiff, Editorial Programmer

Laser Chess™ *is a two-player strategy game patterned after traditional chess—with some fascinating new twists. It was originally written in Modula-2 for Atari ST–series computers, and won the First Prize of $5,000.00 in the Atari ST Programming Contest sponsored last year by COMPUTE!'s Atari ST Disk & Magazine. (For details of the $15,000.00 PC Programming Contest sponsored by COMPUTE!'s PC Magazine, see the announcement elsewhere in this issue.) The PC version of* Laser Chess *was written and compiled with Microsoft's* QuickBASIC *compiler. It runs on any IBM PC, XT, AT, or compatible with a color/graphics adapter and color monitor.* Laser Chess *is found on the magazine disk under the filename LASER.EXE, and the BASIC source code is included in ASCII format as LASER.ASC.*

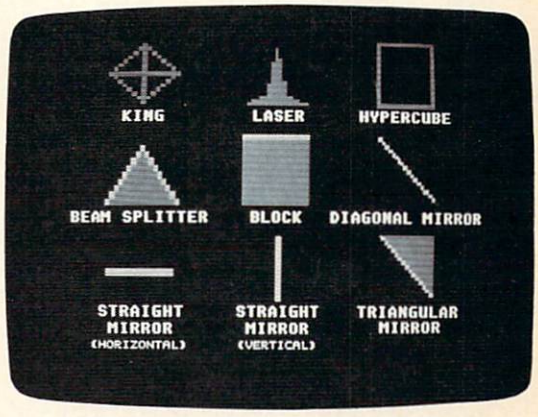
Laser Chess™, as the name implies, is a chess-like strategy game for two players. The goal is to manipulate a laser-firing piece and various reflective objects to eliminate your opponent's king. As in traditional chess, there are an infinite number of ways to accomplish this.

There are eight basic types of pieces in *Laser Chess*, and each has unique capabilities. Over time, you'll learn each piece's advantages and limitations. Obviously, the more you play *Laser Chess*, the more you'll understand the pieces in your arsenal, which in turn will make you a better player. So let's start with a description of the pieces.

A Geometric Army

Figure 1 shows each piece and its name. Notice that some sides of some pieces are highlighted. This indicates a reflective surface. When a laser beam strikes a reflective surface, it bounces off without harming the piece. But if a piece is hit by a laser on a nonreflective surface, it is destroyed.

Figure 1: The basic types of pieces in *Laser Chess*.



A piece can also be removed from the board if it is captured by an opposing piece. This is similar to traditional chess; to capture a piece, you simply move one of your own pieces onto its square.

In addition to their ability to move from square to square, pieces with reflective surfaces can also be rotated in place in 90-degree increments. This lets you orient the piece to protect it against opposing laser shots, or to set up bounce shots with your own laser piece.

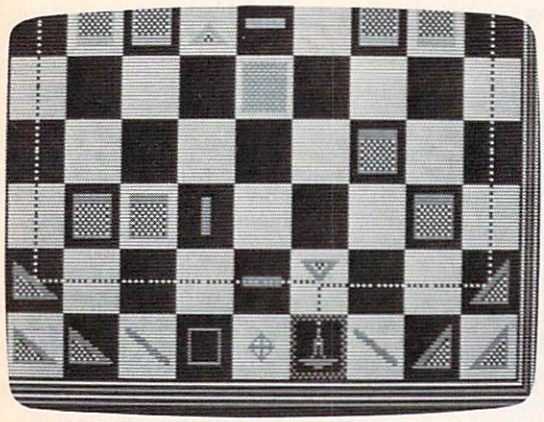
The *king* is the most important piece in *Laser Chess*. When the king is eliminated, the other player wins the game. Since it has no reflective surfaces, the king can be destroyed by a laser from any angle. It can also be captured by an opposing piece. The king is not totally defenseless, however. It can capture any opposing piece by moving onto its square. But this can be done only once per turn.

The second most important piece is the *laser*. This piece is your primary offensive weapon; it's the only piece which can fire a laser shot. To take aim, it can be rotated in place at 90-degree angles. But, like the king, it is completely vulnerable to enemy laser strikes, because it has no reflective surfaces. If you lose your laser, the game is not over, but only the most skillful (or incredibly lucky) player can overcome its loss.

Tricky Pieces

The *hypercube* is an interesting piece. It can't harm an opposing piece directly, but may very well do so indirectly. When the hypercube is moved onto another piece (even your own), that piece disappears from its original position and reappears on a randomly selected empty square. This can be done only once per turn. Thus, the hypercube is a two-edged sword; it may relocate a piece to a vulnerable position or make it possible for the piece to capture an important opposing piece on the next move.

Figure 2: As seen in this magnified view, a beam splitter's vertex reflects a laser shot in two perpendicular directions.



The hypercube has no reflective surfaces and cannot be rotated. It is invulnerable to laser shots, however, because it's made of transparent glass—a laser beam passes right through it. But the hypercube *is* vulnerable to capture by other pieces—even your own. The hypercube relocates a piece only when it is moved onto the other piece; moving a block or a king onto the hypercube will eliminate it from the board. Remember that.

The *beam splitter* is another tricky piece. When a laser beam strikes a splitter's vertex (the point opposite its base), the beam splits in two. The two new beams travel in opposite directions, perpendicular to the original beam's path. (See Figure 2.) When a laser shot hits one of the beam splitter's reflective surfaces, it bounces off at a 90-degree angle *without* splitting. If the beam splitter's base is hit by a laser shot, it is destroyed. The beam splitter can be rotated.

The *blocks* are fairly simple pieces. However, they may impose some complex situations. A block can capture any opposing piece by moving onto that piece's square, much like a king. But unlike a king, a block has one reflective side and can be rotated as the situation demands. Therefore, blocks can be used either offensively or defensively. A laser beam that hits the reflective surface of a block is deflected 180 degrees—bouncing the beam back where it came from.

A *diagonal mirror* cannot be destroyed by a laser, because both of its surfaces are reflective. Diagonal mirrors can be removed from the board only when captured by a block or a king. When a laser beam strikes a diagonal mirror, the beam is deflected 90 degrees. Diagonal mirrors can be flipped to their opposite diagonal, but cannot be rotated to face horizontally or vertically.

The *horizontal mirrors* and *vertical mirrors* (known collectively as *straight mirrors*) are also invulnerable to lasers due to their reflective surfaces. When a laser hits a straight mirror on its flat surface, the beam is deflected 180 degrees. But if the laser hits a straight mirror edgewise, the beam passes straight through it. (Look closely at Figure 2; a laser beam is passing through a horizontal mirror just to the left of the red beam splitter.) Straight mirrors can be rotated to become either horizontal or vertical mirrors, but not diagonal mirrors.

The *triangular mirrors* deflect laser beams just as diagonal mirrors do, but they are vulnerable to hits on their two nonreflective sides. A triangular mirror can be rotated in 90-degree increments.

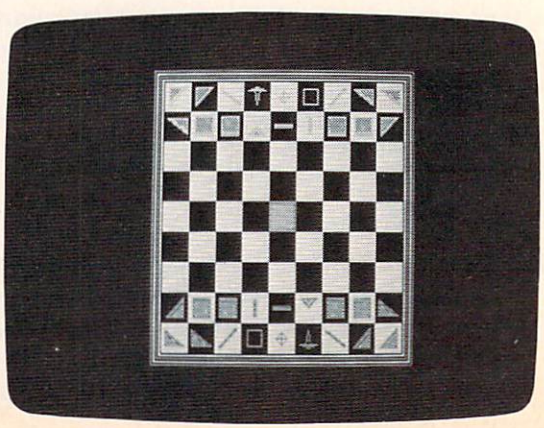
Making Moves

In a game of *Laser Chess*, players take turns making moves, just as in regular chess. However, a turn in *Laser Chess* consists of *two* moves. The color of the border surrounding the playing board indicates whose turn it is (either cyan or magenta), and the thickness of the border indicates how many moves remain in that turn (a thick border indicates two moves, a thin border indicates one move). In Figure 3, for instance, it is the magenta player's turn, and there are two moves remaining in the turn.

The magenta player (at the bottom of the screen) always gets the first move. There's no particular advantage or disadvantage to moving first.

All game functions are controlled with the keyboard. Before moving or rotating a piece, you must se-

Figure 3: A full-screen view of *Laser Chess*, with its 9 × 9 board grid and pieces.



lect it. This is done by moving a cursor to the piece's square. At the beginning of each turn, the cursor is always positioned on the square at the very center of the board. (This square is special for another reason, too, which we'll explain in a moment.) You can move the cursor anywhere on the playing board by pressing the usual cursor-arrow keys. To select a piece, move the cursor to its square and press Enter. When the piece is selected, a checkerboard pattern appears around it.

If you accidentally select the wrong piece, you can deselect it by pressing Enter again. (This won't cost you a move.) Deselecting is usually done after rotating a piece—more on this in a moment.

After selecting a piece, your next decision is whether to move or rotate it. To move a piece, simply position the cursor on the destination square and press Enter. Moving a distance of one square takes one move; moving two squares takes two moves. (To save time, you can move a piece two squares in one step, but it still counts as two moves.) Since you have only two moves per turn, the maximum distance a piece can be moved in one turn is two squares.

Pieces can be moved forward, backward, left, or right, but not diagonally. Of course, you can effectively move a piece diagonally by using two moves—forward and right, for instance. You can even do this in a single action by simply positioning the cursor on the adjacent diagonal square and pressing Enter; if there's a clear path, the computer moves the piece to the square and charges you two moves (one full turn).

You cannot move a piece through other pieces. The only exceptions are captures with blocks and kings, and moves of the hypercube as described above.

Rotating A Piece

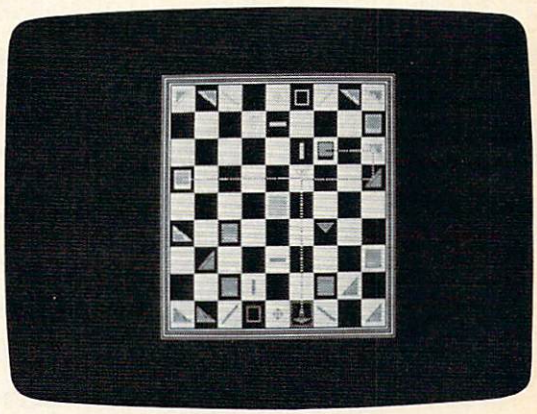
To rotate a piece, select it and press the space bar. If it's not legal to rotate that particular piece, the program won't let you. Otherwise, the piece rotates 90 degrees (one-quarter turn) clockwise. You may continue rotating the piece to any desired position before deselecting it by pressing Enter again.

Rotating a piece to face any direction takes only one move, and the move is subtracted only after the piece is deselected. If you deselect the piece in its original position, the program recognizes this and does not subtract a move. This lets you cancel a rotation if you change your mind.

Special Features

As mentioned above, the square at the very center of the board is special—it's called a *hypersquare*. It absorbs laser beams and relocates any piece that moves onto it. The piece disappears from its original position and reappears randomly on an empty square. This may be done only once per turn, however.

Figure 4: The combination of reflective and transparent surfaces of the various pieces can result in complex bounce patterns. Here, the red laser takes advantage of the green beam splitter to destroy two blocks.



Laser Chess has additional keyboard controls which are available at any time between moves.

The S key turns the sound effects on or off. Normally they're off. There aren't many sound effects in *Laser Chess*, since it's mainly a thinking game, but you can turn them on if you want.

The R key lets you restart a game without finishing the current game. (For instance, a player may be so hopelessly behind that he or she wants to resign.) The program asks you to confirm this choice by pressing Y for yes or N for no.

The Q key lets you quit a game in progress and return to DOS. Again, the program asks you to press Y or N for confirmation.

Firing The Laser

To fire a laser shot, select your laser piece and press the L key. The laser beam remains on the screen long enough for you to observe its path (sometimes it bounces in directions you didn't foresee).

Firing your laser takes only one move, but can be done only once per turn. Therefore, you may want to use your first move in a turn to aim the laser, rotate a reflecting piece to set up a bounce shot, or move another piece into position. Of course, you won't necessarily be firing the laser on every turn. Much of the strategy in *Laser Chess* involves moving and rotating your pieces to set up complex shots.

It's critically important to realize that *any* laser hit on a piece's nonreflective or nontransparent surface will destroy that piece. (See Figure 5.) You can just as easily destroy your own pieces as well as your opponent's. You can even zap your own laser, particularly if you fire directly into the 180-degree reflective surface of a straight mirror or block, or if you fail to anticipate the effects of a beam splitter. Be forewarned.

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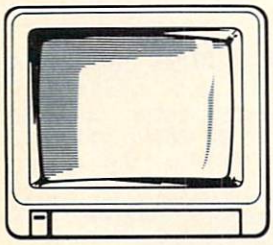

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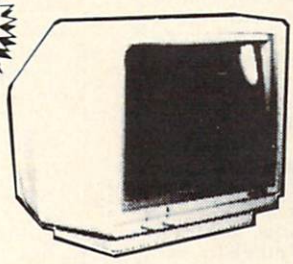

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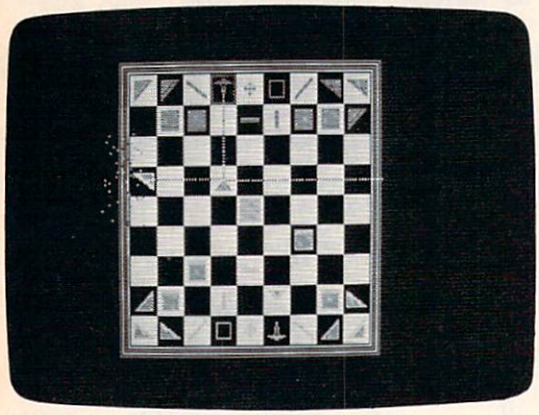
Figure 5: When a piece such as this triangular mirror is hit by a laser beam on a vulnerable surface, it explodes into bits.



Advice On Play

Get your mirrors out early. Use them to gain the fullest potential of your laser. Try to position mirror networks on both sides of the beam splitter so you can inflict as much damage as possible.

Take advantage of the blocks. Since they "control" an area around them with their threat of capture, no other pieces can safely move within their range. Make your opponent work to displace them. Remember to rotate the reflective side of a block toward the most probable direction of laser fire. If you can prevent a laser from destroying the block, your opponent will most likely have to gang up on it with two or more of his own blocks.

Use mirrors to protect your king. If you surround your king with straight and diagonal mirrors, there is no way it can be hit by a laser. Therefore, your opponent will have to break through your defense with blocks. (This is a pretty dirty trick, because if your opponent loses all of his blocks, your king is almost invulnerable.) Defending your king with blocks is also a good strategy.

The hypercube should be used sparingly, since you have no idea where a relocated piece will reappear. Most players use the hypercube as a last resort—if another piece is going to be destroyed anyway, it doesn't hurt to take a chance and relocate it with the hypercube. Also, if your opponent decides to encircle his king with mirrors, you can march right in with your hypercube, followed by a block. This tactic may displace your opponent's defense, forcing him to evacuate his king from its mirrored fortress. Escorting the hypercube with an adjacent block prevents the opponent from attacking the hypercube with his king. Your opponent's only options will be to flee or be displaced. **PC**

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A *Flight Simulator* Adventure

Gearing Up For Top Performance

Microsoft's Flight Simulator *is one of the most popular programs available for IBM PCs and compatibles, and many thousands of PC owners enjoy soaring through the clouds now and then. This article covers some of the finer points of flight control for those who want to polish their technique. A copy of* Flight Simulator *is required. Charles Gulick is the author of* 40 Great Flight Simulator Adventures *(COMPUTE! Books, 1985),* 40 More Great Flight Simulator Adventures *(COMPUTE! Books, 1986),* Flight Simulator Co-pilot *(Microsoft Press, 1986) and* Runway USA *(Microsoft Press, 1987).*

If you've been flying *Flight Simulator* for a while, it's time you learned how to get some extra performance from your Cessna 182. Most people tend to fly with the landing gear permanently down, as if fixed, and with the auto-coordination feature enabled. Both help to make the plane easier to fly. The Cessna 182 with gear down behaves more like a tame Cessna 150 or a 152 trainer, and auto-coordination links the rudder to the ailerons for smoother turns.

But perhaps now you're ready, or soon will be, for a more professional approach. I'll show you how to handle the 182 properly, flying gear up and with rudder control independent of the ailerons. It will take a little work on your part, mainly because it involves a change of habits. But with gear up, you'll be rewarded with that 133-knot cruising speed that has eluded you until now; and, with independent rudder, you'll have far better directional control and the ability to make better landing approaches. In addition, I'll show you how to make a high-performance takeoff in the Cessna—lifting off at under 60 knots—and how to trim down quickly for a climb-out at optimum speed.

Charles Gulick

Controlling The Rudder

After entering the parameters below into your *Flight Simulator*, you'll find yourself on the ramp at Block Island State Airport, Block Island, Rhode Island. You're pointed toward the taxiway to Runway 10. (Deer and flocks of birds frequent this airport and its runways, so be on the lookout.)

As usual, if your compass doesn't settle within a degree of the correct heading (228 degrees), go into the Editor, reenter that heading, and try again.

Experiment with your left and right rudder controls. (Check your manual if you don't know which keys control your rudder, and be sure you know how to center the rudder, using the same key that neutralizes your ailerons.) Note that when the rudder position indicator moves, the aileron position indicator doesn't. When auto-coordination is enabled, of course, the rudder and ailerons move together, which obviates skidding or slipping in turns.

Theoretically, when flying with independent rudder, you should apply a bit of rudder in turns, in the same direction as you apply the ailerons, keeping the ball in the bank-and-turn indicator centered. In simulator flying, however, rudder control in a coordinated turn is rather awkward and unnatural; the simulator will forgive you if you don't execute it well (or, for that matter, if you ignore it altogether). In simulator flying, we're most interested in the rudder for what it does all by itself rather than for its coordinating capabilities.

Add some power and start moving along the taxiway. Turn right and parallel the runway to the

Note: To begin this adventure, load and run your copy of *Flight Simulator* and enter the parameters listed below. If no parameter is specified, use the default setting. We recommend using keyboard controls instead of the joystick for this flight. Also, you may want to read through the exercise before you start flying, so you'll know what the flight involves.

Editor Parameters

User mode		10 (automatic with parameter entry)
Auto-coordination		0
North position		17352
East position		21749
Altitude		0
Heading		228
Surface wind:	Knots	5
	Degrees	95

end; then make a 180-degree turn and hold short of Runway 10. *Holding short* means stopping the aircraft off to one side of the runway threshold, usually at the request of the control tower. The tower will then follow with instructions for you either to taxi into position or to proceed with your takeoff.

If you have trouble taxiing, start over again and practice—taxiing skills are vital to both realism and your overall proficiency.

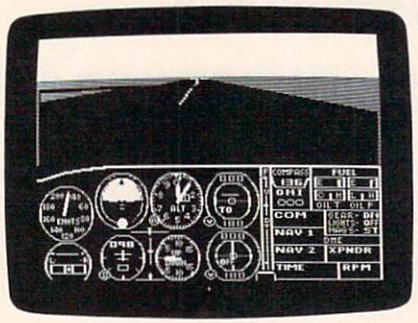
As you taxi, steer with the rudder pedals. It isn't the rudder that's turning the aircraft, of course, but your nose wheel controlled by the rudder pedals. When you center the pedals, the nose wheel straightens automatically. During a takeoff run, the rudder takes over just about when nose wheel steering becomes ineffective. The relative wind against the rudder airfoil at that point is sufficient to control the plane's direction.

The High-Performance Takeoff

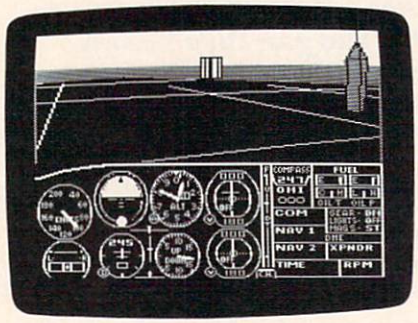
When you are stopped short of the runway, prepare for your takeoff as follows:

- Be sure the carburetor heat is off.
- Extend the flaps 10 degrees.
- Press up-elevator until the elevator position indicator moves up as far as it will go, then apply five quick presses of down-elevator. This is your trim for the upcoming high-performance takeoff.

Now the tower asks you to taxi into position. Add a little power, move onto the runway, point the aircraft toward the far end, and stop again, waiting for takeoff clearance.



Preparing for takeoff from Block Island State Airport in Rhode Island.



Retracting the landing gear makes it easier to maintain optimum cruising speed.

"Cessna Niner Four Papa, clear for takeoff." (*Niner Four Papa* is an abbreviation of your aircraft numbers, which are N3394P. How do I know those are your numbers? Because it says so right here.)

Add power to begin your takeoff run. Steer as needed with the rudder pedals; the aileron now does nothing. Get pointed reasonably straight down the runway, and then push the throttle to the wall.

Watch your airspeed indicator. As the needle edges between the 40- and 60-knot indications, rotate with one press of up-elevator. The airplane will be off the ground at about 55 knots.

As soon as you're flying, apply one press of down-elevator, canceling the pressure you used for rotation. Don't forget to do this, or you won't trim out properly. Then immediately retract your landing gear and dump your flaps (return them to the zero position).

Trim And Climb-Out

Next, you'll trim relatively quickly to what's known as *operational neutral*. The op neutral for gear-up configuration is different than what you're accustomed to for fixed-gear flying. Here's what to do.

As the airplane climbs, apply six sets of two quick presses of down-elevator. This procedure can be abbreviated as *6x2qds*, with *qds* standing for *quick downs*. Each two qds should be applied as the horizon, as seen through your windshield, moves downward—and only then. If the horizon is moving upward, even though the vertical speed indicator (VSI) may show you are climbing, or if it hangs motionless for a few seconds, wait; wait until it starts downward again. When it does, apply these two quick downs six times in all, counting while you do them. (However, if you lose count, observe your elevator position indicator; stop trimming down when a final set of two qds puts the indicator a full notch below its center position.)

When you trim out, you'll be at op neutral for gear-up configuration. Then, and only then, back off your throttle for a reading of 2105 rpm. The aircraft will settle into a climb at the rate of about 500 feet per minute (fpm), and your indicated airspeed will move up until the needle is close to the 0 of the 120-knot reading.

Your actual airspeed on the climb-out will be about 128 knots. (The airspeed indicator reads incor-

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rectly in all of the Microsoft versions of *Flight Simulator* I've seen; if you check the Editor, you'll see that you're doing between 125–130 knots.)

Your aircraft is designed to cruise at about 133 knots under optimum conditions. Any airspeed within a few knots of 130 means you're getting optimum performance. Op neutral lets you climb at nearly cruise speed. That's the beauty of correct trimming.

Altitude Control With Throttle

Once you're trimmed to op neutral, altitude control becomes purely a matter of power adjustment. To level off, simply reduce power to 1955 rpm. Your airspeed will settle at the optimum cruise speed for your altitude and the environment in which you're flying.

Want to climb a little higher? Add a little power. Want to descend a few hundred feet? Back off your throttle a bit. Don't touch your elevator at all. It's already where it's supposed to be. This gear-up operational neutral will serve you beautifully in virtually every cruise condition. The only time you may need to trim up a press or two will be at very high altitudes—those your aircraft can't handle with power alone.

At op neutral, you have to adjust power as needed for the result you want. If you're having trouble holding your altitude at, say, 1955 rpm, make a one-notch power adjustment up or down, as the case calls for. On the PC, take advantage of the F6 function key, which affords a 50 rpm increase, or the F8 key, which provides a 50 rpm decrease. Think of your throttle as your altitude control, because that's exactly what it is: Add throttle, you'll climb; reduce throttle, you'll descend. And you control not just the climb/descent configuration, but also the rate at which you climb or descend—all with the throttle.

So if throttle controls altitude, what controls airspeed?

Primarily, elevator.

If, from cruise configuration, you apply gradual back pressure (up-elevator) and at the same time reduce power, the aircraft will nose up but won't climb significantly, and it will gradually slow down to whatever airspeed you want. It is the combination of throttle setting and elevator position (in effect, elevator trim) which controls airspeed.

To slow-fly the airplane—for instance, when approaching an airport—simply reduce throttle and trim the elevator up, in a combination and at a rate which makes the airfoil do what you want it to do. The proper combination of power and trim will let you fly straight and level right down to an airspeed just above stalling. Your plane's nose will be high and the power setting low. But the plane won't lose or gain significant altitude—if you play trim against power correctly.

But do it slowly. Give the airplane time to react and regain its balance with each new setting. You can't rush procedures like this if you want to execute them well.

Practice Makes Perfect

From straight and level flight, practice making the transition to slow flight at any random speed you select. Begin with a power reduction (preceded by application of carburetor heat if you're going to reduce power significantly). The aircraft, as we already know, will want to descend. Prevent that descent by gradually applying up-elevator. Then reduce power a little further.

Again, answer the resultant tendency to descend by applying more up-elevator (no "quicks" here; just one press of up-elevator at a time). Watch your airspeed indicator. Keep trading off power and trim, and the airplane will slow down. If you trade them off in a combination which keeps the aircraft at its original altitude, you'll soon settle in at your desired airspeed.

A useful way to set up a standard descent rate (approximately 500 fpm) is simply to apply carburetor heat without any immediate power reduction. The result is the same as if you'd backed off your throttle about 100 rpm. You'll enter a nice, gradual descent. You should use carb heat anyway when you plan a throttle reduction; it prevents carburetor icing, and it's a standard approach and landing procedure.

If you want to make the transition from cruising speed to slow flight and at the same time descend rather than hold your cruising altitude, simply work the controls so that your combination of throttle reduction and up-trim nets that result. You'll find, with some practice, that you can descend (as well as climb) at any rate you want or need.

Gear-Down Procedure

Now, what about dropping your gear in preparation for a landing? You should do this during slow flight, not at normal cruise speeds.

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Extending the gear of course adds drag, and the result is that the airplane will start to descend; or, if you're already descending, your rate of descent will increase.

Try it. From slow flight at about 80 knots, with carb heat on and power at 1400–1500 rpm, drop your gear. Now, watching the VSI, you'll see that simply dropping the gear sets up a gentle descent with little or no change in airspeed. If you want to descend, fine. If not, add 100–150 rpm *before* you drop the gear, and you'll hold close to your original altitude.

Alternatively, if you want to slow down the aircraft as well as extend the gear—for example, on final approach—use either up-elevator to counteract the landing gear drag or a combination of elevator and power.

The point is, fly the airplane. You have the principles of flying now; just apply them judiciously for the result you want.

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Rudder As Directional Control

Finally, let's consider how you can use your independent rudder to fine-tune a heading or, on a landing approach, your direction in respect to the runway.

Say you've been flying a heading of 260 degrees, but you've neglected your instrument scan for a few minutes and your compass now reads 263. You want, of course, to make a 3-degree correction to the left. Were aileron and rudder coordinated, you'd have to put the plane into a left bank—but only briefly. *Very* briefly. And often it's in the nature of such an operation that you overshoot, so our example heading might now be reading 258 degrees. That calls for still another turn, this time to the right—just to add two degrees to your heading.

With rudder control independent of aileron, all that aileron work is unnecessary. A few taps of left or right rudder, followed by neutralizing or centering, will yaw the nose around so you're pointed where you want to go. The aircraft typically will not bank at all; if it does, you're probably applying rudder a bit too eagerly.

It should be noted that an aircraft can be flown without any ailerons at all; witness the radio-control "rudder-only" masters. Try a few turns (let the aircraft bank this time), using just the rudder. Neutralize when you have the degree of bank you want. Then use opposite rudder to bank and turn in the opposite direction and resume level flight.

During landings, use a little left and/or right rudder to improve your alignment with the runway. It will give you those incremental changes in direction so important to precision touchdowns rather than the wild gyrations typically experienced with alternating aileron turns.

Brake For Birds

So now you have some (possibly) new tricks to add to your repertoire: better and more realistic directional control on the ground, by operating the nose wheel with your rudder pedals; a high-performance takeoff and climb-out that will have you climbing at nearly optimum cruise speed a few hundred feet off the ground; a real-world retractable gear procedure that will net you real-world airspeeds; altitude and airspeed control techniques that will yield any airspeed you like—climbing, flying level, or descending—by savvy application of throttle and elevator trim; and precision final approaches which rely on rudder rather than auto-coordination for setting the plane down silkily and on the centerline.

Use this practice flight as a springboard for practicing your new techniques, beginning on the ramp at Block Island State. But keep a sharp watch and yield to any birds or deer you see on the runway. Your Cessna 182 isn't a hunting license. And the birds, after all, taught us how to do this thing. **PC**

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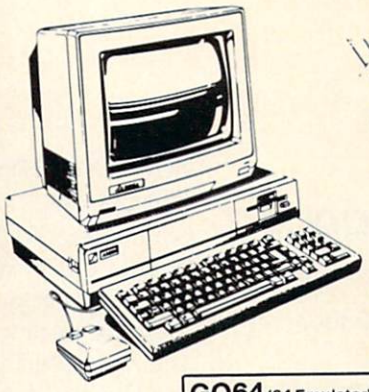

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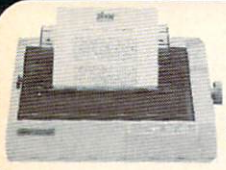

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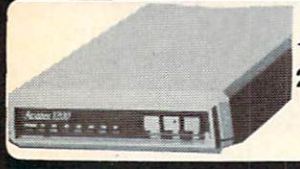

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The Norton Utilities, Advanced Edition

Keith Ferrell, Features Editor

Requirements: Any IBM PC, XT, AT, or compatible with at least 128K of memory and DOS 2.0 or later.

Sometimes a good thing *can* be made better.

That's the case with this latest and most sophisticated edition of Peter Norton's famous *Utilities*. Widely respected and appreciated for its effectiveness in recovering lost, mangled, or accidentally erased data, *The Norton Utilities* package has been extended over the years to include a utility that improves hard disk performance by reducing the fragmentation of files, disk management functions, and many other useful programs. All of them are accessible via the Norton Integrator, a "point-and-shoot" menu that makes putting the utilities to work a breeze.

It is data recovery, though, for which Peter Norton is best known, and the latest edition of his package remains the benchmark against which all other recovery programs must be measured. The restoration of lost, erased, or even reformatted files may be approached in a couple of ways with *The Norton Utilities*. The fastest method is with Quick Unerase (QU), a handy method for near-instant recovery of a just-erased file. QU will pursue all erased files in a directory, and is most likely to be successful if used immediately after erasure. (Once the disk has been written to, there is less chance of recovering missing data.)

Solves Even Serious Problems

No matter. (Well, *nearly* no matter.) Should QU prove unable to recover the file, Norton offers other strategies. For instance, there's Norton Unerase, which is the real heart of the *Utilities*. It allows you to recover most erased files which have not yet been overwritten.

Upon selecting Unerase from the menu, the program displays a list of all erased files in the directory in question; point-and-shoot allows for easy change of directory and drive, if necessary. If the file has not been overwritten, its recovery should be as simple as highlighting the filename and pressing the appropriate keys (all clearly indicated by menu and help screens).

All is not lost, though, even if your missing files prove to be housed in damaged clusters (a *cluster* is a section of data on the disk). *Norton Utilities* does not give up easily. With Text Search (TS), a hard disk can be scanned for clusters containing the text you're looking for; once all the clusters are found, the program guides you through their recovery and reassembly into a new file. This procedure can also be pursued at the sector level (a *sector* is a smaller unit of a cluster), and every stop of it is "point and shoot," Norton's method of quick access to menu lists.

The Norton Utilities lets you explore your hard disk—floppies, too—providing technical and diagnostic information as you go. There is a map showing disk usage that lets you find the location of each of your directories, subdirectories, and files. Representations of bad clusters blink on the screen, a flashing reminder of their potential for causing trouble. Technical information screens accessed during an exploration offer profiles of disk areas and their contents.

The exploration of a hard disk can also reveal the amount of *fragmentation*, the scattering of file and program data over disparate areas of the disk. Fragmentation results when the drive searches a crowded disk for free clusters on which to write. The more crowded the disk, the more likely that data will be written in separate areas; as data becomes more fragmented, the time required to access it grows, and the computer seems to be running slower.

New Advanced Features

One of the features that earns this edition its *Advanced* subtitle is Speed Disk. This utility examines hard disks for fragmentation and then rearranges the data, moving file clusters so that the contents of each file is as contiguous as possible. Once this is done, disk access is generally speedier.

Other features of *The Norton Utilities* assist in disk management, optimization of disks, and increasing the usefulness of batch files.

Disk Test examines both hard and floppy disks for physical damage, giving users the option of marking bad clusters as unusable—essentially building a wall around problem areas on the disk. Much more thorough than DOS's CHKDSK, the Norton Disk Test should be run with some frequency to monitor the safety of your information. Through the Integrator, users also have the option of previewing the contents of each cluster before saving it to a file.

System Information gives you a fast, snapshot look at the operating characteristics of your PC, in-

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cluding its computing index relative to an IBM PC. Screen Attributes is used to vary the intensity of screen colors.

For security-conscious users, File Attributes lets you mark files as *read only*, insuring that they cannot be overwritten.

Some of the less dramatic, but equally helpful features of *The Norton Utilities* include Time Mark, which automatically logs the start and stop times and the duration of any computer operation; Beep, which lets you add sounds to batch files; Directory Sort, with which directories can be reorganized using a variety of parameters; File Find, exceptionally useful, too, with which you can quickly locate any file on a hard disk; and File Info, which lets you add commentary to filenames. File Info is new with this edition of the *Utilities*. With it, you can easily keep track of the purpose and instructions for any file.

Exceptional Documentation

As usual, Norton expended the same care on the manual as on the utilities themselves. All documentation is clearly written, with the tone of a patient, sympathetic, and concerned instructor. Both manuals and tutorials also contain instances of gentle humor, jokes you might find welcome while tackling the mechanics of hard disk management and file recovery. Accompanying the *Utilities* is a booklet, *Understanding Your Disks*, that manages in a few pages to provide a surprisingly thorough yet easy-to-understand introduction to disk management, organization, and operation.

Having been through hard disk problems both with *The Norton Utilities* and without it, I feel confident in saying that, in terms of the time it saves, at $150, *The Norton Utilities: Advanced Edition* is not expensive at all.

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PageMaker

Tom Campbell

Requirements: IBM PC AT or compatible with ten-megabyte hard disk, 512K of memory, Microsoft Windows *or* Windows *runtime package (supplied),* Windows*-compatible mouse, and DOS 3.0 or higher. Laser printer highly recommended.*

PageMaker, by Aldus, costs almost $700, but from the very beginning you get the feeling it's worth every cent. Gorgeously packaged, lavishly illustrated, and beautifully laid out, it reeks of quality Months of use do nothing to remove that impression, although it is not without its shortcomings.

Buttressing its high-class feel is the fact that *PageMaker* won't run on an ordinary PC. It requires the horsepower of an AT-class machine with a hard disk drive and a mouse. For this review, *PageMaker* was tested on two computers: an 8-megahertz AT clone with two megabytes of RAM and an Enhanced Graphics Adapter (EGA), and a stock 6-megahertz IBM PC AT with 512K RAM and a Hercules display. The difference in performance was significant. The printers used were an IBM Proprinter and a Hewlett-Packard LaserJet Plus with two megabytes of RAM and downloadable fonts. A 12-page magazine was produced using *Microsoft Word* and *WordStar* to prepare the documents.

PageMaker is already one of the most popular desktop publishing packages, currently leading the market in both the Apple Macintosh (where it originated) and PC arenas. It lets you tie together text and graphics from disparate sources, combine them into a single document (or *publication*, in *PageMaker* parlance), and then format that document with multiple columns, ruled lines, and typographic special effects. In general, it lets you perform many of the jobs that were once the exclusive domain of the pasteup artist.

Of course, *PageMaker* won't instantly give you any extra artistic talent. (Maybe that's how artificial intelligence will fit into the next generation of desktop publishing software.) But it does make it possible for you to create finished documents that just aren't feasible with ordinary word processors.

Painless Installation

Installing *PageMaker* is simplicity itself. The *PageMaker User Manual* points to the Installation Guide, a 30-page booklet that explains how to install *PageMaker*, Microsoft *Windows* (where necessary), soft fonts, and the operation of *PageMaker* on networks. Most users can simply insert the Install disk in drive A and enter INSTALL at the DOS prompt.

A slick .EXE program, not a batch file, runs the installation procedure. Along the way it alters CONFIG.SYS (adding more files and buffers if they're set too low or not at all), and AUTOEXEC.BAT (adding the *PageMaker* and *Windows* directories to the path), first asking your permission. Unlike many other programs, which clobber these files with nary a hint to the user, the *PageMaker* installation program gives you complete control and lets you continue installation without those changes—a significant consideration in a network environment.

If you don't already own Microsoft *Windows*, a trimmed-down runtime module is installed for you. It contains the bare minimum of *Windows* required to operate *PageMaker*.

If you're a power user who wants to know what's under the hood, the manual contains impressive coverage of the entire installation procedure. You can even install *PageMaker* manually using this information, bypassing the automatic INSTALL program altogether. This section proved useful after a deliberate attempt to crash *PageMaker* to test its error handling; what seemed like a bug turned out to be a user error.

In addition to the Installation Guide, you also get the 310-page

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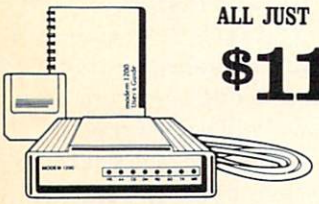

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PageMaker User Manual, a 148-page Reference Manual, a fold-out quick reference guide, and a supplement containing errata and late-breaking news. The larger manuals are wire-bound to lay flat, and the *User Manual* has convenient tabs dividing the chapters. All of the documentation was produced with *PageMaker* and typeset on a Linotronics 100P, except for the supplement, which was done on a laser printer.

Overall, the documentation is impressive and among the best I've ever seen—a vital consideration in a program of this scope. The only point to criticize is that it's a little short on heavy-duty technical information, such as details on memory usage, specifications on how graphics are imported, and so on.

Helpful Tutorials

Each section in the *User Manual* begins with a table of contents, followed by explanations of major topics. Important pieces of information are highlighted with a Tip box for quick reference. The manual starts out with a tutorial in which you create a nice-looking newsletter using sample text and images supplied with *PageMaker*.

Following that is what amounts to a course in desktop publishing mixed with how-tos on all the major features of *PageMaker*. It not only teaches how to use *PageMaker*, but also supplies enough background so you can use the program to its fullest. For example, the section on *leading* (the blank space between lines of type) explains the reasoning behind *PageMaker*'s default settings as well as how they can be adjusted. Features which aren't covered in the *User Manual* are discussed in the Reference Manual.

As mentioned above, however, the manuals are a bit spotty in fairly technical areas. For instance, when you import a *Lotus* .PIC file, can you edit any of its text or change its text attributes? The answer is no, but it's not covered in the manuals.

PageMaker's online help screens are also somewhat lacking—compared to, say, *Lotus 1-2-3*. When you choose Help from the System menu, select a topic from a list, and click the Help button, a screenful of text appears. But it's not context-sensitive, unlike the help screens found in other sophisticated MS-DOS applications. Still, most *Windows* applications don't bother to provide online help at all.

There is no disk-based tutorial included with *PageMaker*. Although you can follow along with the printed tutorial while using the program, there's no safety net and you can easily get lost. Even so, the tutorial in the *User Manual* is challenging and rewarding; it's a good, typical use of *PageMaker*, not a contrived toy application.

Much Like The Mac

If you're already using *Windows*, you have a head start when learning *PageMaker*. It adheres closely to *Windows* conventions for text editing, drawing tools, menus, and so on. Macintosh experience is also a plus. The PC version feels very much like the Mac version, and it has many more features than the original Mac version, which has since been updated. According to Aldus, they share quite a bit of source code.

Some features of the PC version imitate the Mac version where there's no *Windows* convention. For example, the oval tool draws ovals by default, but draws circles if you hold down the Shift key while drawing; likewise, the rectangle tool draws squares if you hold down Shift.

PageMaker is compatible with a very wide variety of text and graphics files. Graphics formats include *AutoCAD*, Encapsulated *PostScript* (EPS), *Lotus* .PIC, *PC Paint*, *PC Paintbrush*, *Windows Draw!*, *Windows Paint*, TIFF scanner images, and *Windows* metafiles. It retains color information, although most printers don't support color.

TIFF files are stored in a format jointly devised by Aldus and Microsoft which was released to the public domain in late 1986. TIFF images are compact bitmap files that preserve colors, gray scales, and black-and-white information; they've rapidly become a standard and are supported by all major scanner manufacturers.

Text file formats include Document Content Architecture (DCA), which is supported by word processors sold by IBM and others; *WordStar*; *WordPerfect*; *Windows Write*; *XyWrite III*; *MultiMate*; and plain ASCII. *PageMaker* retains quite a bit of formatting when loading these files: font, font size, font attributes, line spacing, case, tabs, left margin, left and right indents, hanging indents, and hard carriage returns. Trickier formatting is ignored. For example, *Microsoft Word* can create pages with more than one column, but *PageMaker* brings them in as separate paragraphs.

Starting A Document

When creating a document with *PageMaker*, you must keep in mind that it shows the document on-screen as it will appear on the printer you've selected. In other words, the same line of text printed in Times Roman 10 on an Apple LaserWriter doesn't break in the same place that it does when printed on a LaserJet Plus using a cartridge, or even a LaserJet Plus using software fonts. For this reason, the *PageMaker* manual suggests that you specify the target printer when starting. If you switch printers in midstream, *PageMaker* has to reformat the entire document.

Once you've chosen the printer, you choose the New option from the File menu to begin work on the new document. But you can't just start typing. Among other things, *PageMaker* asks how long the document will be. Why does it want an initial page estimate? We don't know, and no one at Aldus could come up with a good reason, either; it's not in keeping with the *Windows* philosophy of letting the program keep track of the bookwork whenever possible. It hardly

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matters, though. *PageMaker* lets you add and delete pages to your heart's content, and during testing it never referred back to the initial estimate.

Another early decision you have to make is whether your document will be printed on both sides of the paper. This determines whether something called the *master page icon* at the bottom of the screen will show a single page or two. The master page icon lets you specify attributes that appear on every page of the document, such as headers, logos, vertical rules, and multiple columns. (These items can be omitted from certain pages, of course.) If your document is two-sided, the master page icon appears in two halves, representing the left and right pages. This lets you easily adjust things like the inside margin, which is often bigger to leave room for staples or binding.

With master pages, you can create *templates*—empty documents to be used as starting points for frequently repeated items such as newsletters and price lists. At least one independent company has already exploited this capability by issuing a disk full of templates.

Laying Out Text

The bulk of the 12-page magazine produced when testing *PageMaker* consisted of text-only articles, each with a headline and pull quotes (also known as quote boxes or readouts—short excerpts pulled from the article and set in larger type to add visual interest to the page). The magazine was generally laid out in two columns; *PageMaker* lets you mix several different column formats on the same page. There wasn't much artwork in the magazine. In fact, the only image was the logo on the front cover. For testing purposes, the image was imported from separate outside programs.

Importing text was simple. *PageMaker* has an all-purpose Place command which lets you import either text or graphics. The dialog box that opens on the screen when you select this command looks just like any other *Windows* dialog box for loading files. It lists all files with compatible extensions, such as .DOC for *Microsoft Word* files, .PIC for *Lotus* images, and so on.

One quirk is that it expects *WordStar* documents to have a .WS extension, conveniently ignoring the fact that *WordStar* likes to use .DOC. This is doubtless because *Word* and *MultiMate* also use the .DOC extension, giving *PageMaker* a tough enough time as it is. Selecting a *WordStar* document with the .DOC extension brought up a dialog box explaining that *PageMaker* didn't know the document type. It then displayed a list of text and graphics formats to choose from. Clicking *WordStar* on this list did the trick, and the document was imported without complaint.

Once a file is chosen, the cursor changes into an icon for placing the file in the document. You simply draw a rectangle where you want the text to appear, and it pours into place—observing the column guides and margins. If the text is longer than a full column, a nonprinting symbol at the bottom of the column indicates that all the text didn't fit. To add another column anywhere in the document, you just click on this symbol, draw the new column, and repeat the process until done.

Manipulating The Page

For added flexibility in laying out pages, *PageMaker* has an invaluable toolbox, which appears as a window that you can turn off or move anywhere on the screen. The toolbox contains a pointer (for selecting text frames and graphic objects, and for manipulating the document in other ways), some drawing tools, a text tool, and a cropping tool (for situating graphics objects within their frames).

The toolbox came in especially handy when creating pull quotes. All you do is type the quote, enlarge it, drop it into the middle of the page, flow text around it, and use the line tool to draw rules above and below it.

PageMaker carries the *Windows* desktop environment to its logical conclusion: You can leave objects lying around anywhere on the work area (called the Pasteboard), not just on the document. It's nice to be able to import images and leave them lying in view while paging through a document.

Imported graphics normally are surrounded by an opaque box, but you can nullify the background color to make it go away. Images can be moved around the box using the cropping tool, and you can change their aspect ratios to fit a certain space.

The ability to import graphics is good for much more than integrating images into your documents. For instance, let's say your laser printer can't produce type larger than 36 points (½ an inch). You can nevertheless achieve headlines of almost any size by preparing the type with a graphics program, importing the file into *PageMaker*, and arranging the headline on the page as if it were a graphics image.

Stick To Short Documents

PageMaker doesn't automatically generate tables of contents, indexes, or article jumps (when an article is continued on a distant page). This makes sense, since *PageMaker* is designed for fairly short documents. Although Aldus claims that a *PageMaker* document can be up to 128 pages long, it would be extremely difficult to construct one. Besides, due to memory limitations, documents with lots of graphics and complex formatting can't extend to anywhere near that length. It's called *PageMaker*, not *BookMaker*.

Another limitation is text can be made to flow around or behind graphics, but graphics never move with the text. In other words, if you create a 20-page manual with illustrations, then find you have to add three pages of text at the beginning, you'll find that the graphics retain their absolute positions. They don't float the way paragraphs do.

Because *Windows* places notoriously heavy demands on the hardware, running *PageMaker* on a minimal system can be trying. The 6-megahertz PC AT with only 512K required a lot of disk swapping when *PageMaker* was used with even a small application like the *Windows* notepad. The same was true when the document grew longer than 16 or so pages, or when a document contained complex formatting. Performance was much snappier on the 8-megahertz AT clone, which sports a couple of megabytes of zero-wait-state RAM. Again, this is due to *Windows*, not *PageMaker* itself.

The speed of the laser printer drivers is not very impressive, either. An 8½ × 11 inch page with an image imported from *AutoCad* took almost 35 minutes to print on the LaserJet Plus.

If you run into problems when using *PageMaker*, the Aldus technical support people are quite good. They're willing to help with output device problems (always a major consideration with desktop publishing programs), they're courteous, and they know what they're talking about. But be sure to start using *PageMaker* and encountering most of your problems soon after you register, because Aldus charges for support after the first 45 days. The paid support entitles you to a newsletter and free updates. Note that anyone can reach the Aldus support people via the CompuServe Information Service.

In conclusion, *PageMaker* is a well-designed, wonderfully executed product. It's ideal for producing short- to medium-length documents, and it's compatible with many kinds of graphics and text files. *PageMaker* is clearly a product that's here for the long haul. It deserves to be.

PageMaker
Aldus
411 First Ave. South
Suite 200
Seattle, WA 98104
$695

Words & Figures

Tom Campbell

Requirements: IBM PC, XT, AT, or compatible with at least 256K of memory and DOS 2.0 or higher.

Words & Figures is a hybrid program that offers a spreadsheet which is extremely compatible with *Lotus 1-2-3* Version 1A, integrating it with a simple but capable word processor.

Lotus 1-2-3 and its clones aren't just spreadsheets, of course. They let you generate graphs based on the worksheet data, and they provide simple database functions as well. Although it was really the powerhouse spreadsheet that made *1-2-3* a classic, a small but influential group of users have made extremely effective use of the additional features. For example, some people use *1-2-3* for project scheduling as well as for budget tracking. *Words & Figures* might be just the ticket if you want to bring your *1-2-3* Version 1A spreadsheet models home from work or if you run a small business and need a spreadsheet with an integrated word processor.

But first, a few caveats. *Words & Figures* is not compatible with Version 2 or later versions of *1-2-3*. On the other hand, *Words & Figures* is available for less than what *Lotus* charges for its Version 1A to Version 2 upgrade. Yet, it's as much spreadsheet as most users will ever need.

Second, the integral word processor won't completely replace *WordPerfect*, *WordStar*, *PC-Write*, or *Microsoft Word*. But it does give you a simple editor with a few formatting options without leaving your worksheet. This review was easily written using *Words & Figures*.

Two Versions Included

The *Words & Figures* package comes with three disks: the Small Program Disk, the Large Program Disk, and the Installation/Graphics/Tutorial Disk. The Small Program Disk contains a version of *Words & Figures* that uses less memory by swapping parts of the program between the computer and the disk. It works fine on a system with only 256K and two floppy disk drives, and it's functionally identical to the regular version on the Large Program Disk.

Installing either version on your system is easy. Just type INSTALL at the DOS prompt, and a batch file automatically does the rest.

The manual is attractive, complete, and well-written. It includes a brief Getting Started guide, a Quick Reference booklet, a Menu Directory, and a Customer Assurance Plan. The Quick Reference booklet is very well done. I never had any problems looking up what I needed, and the index is complete.

Compatible Macros

Functionally, the *Words & Figures* spreadsheet works almost exactly like *Lotus 1-2-3*. So instead of discussing all the similarities, let's examine the critical differences.

You can switch between the spreadsheet and word processor modes by choosing the appropriate option from each application's root menu or by pressing the Alt and F10 keys. The program's opening menu also lets you choose between the two applications, but to maintain compatibility with *1-2-3*, macros ignore this feature and go straight to the spreadsheet.

In general, by the way, that's how macros behave in *Words & Figures*. Any interactive steps you might perform which are incompatible with *1-2-3* macros are automatically corrected or ignored by *Words & Figures* macros. This gives you the best of both worlds—an enhanced spreadsheet program that still lets you use your *1-2-3* macros.

The spreadsheet enhancements over *1-2-3* Version 1A are conservative and thoughtfully carried out. Averaging blank cells returns a zero, not an error. You can create hidden columns by setting their width to zero. Displaying range

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names also shows cell addresses. Columns can be up to 127 characters wide. Memory is managed much more efficiently, so you can leave lots of blank space between parts of the worksheet without gobbling up RAM as *1-2-3* Version 1A does.

Words & Figures stores worksheets on disk in either *Lotus*-compatible .WKS files or its own .WAF format. It defaults to .WKS files, of course, and loads *1-2-3* Version 1A .WKS files without complaint. If you already have a large library of .WKS files created with *1-2-3*, they'll work perfectly with *Words & Figures*. They require no translation, even if they contain macros.

The *Words & Figures* word processor saves documents in its native .WAF format or in .PRN files. The latter are plain ASCII text files, like those created with Borland's *Sidekick* notepad.

Good Integration

Words & Figures has a number of interesting features made possible by its integrated word processor. It's much more than just a fancy notepad tacked onto a spreadsheet program.

For example, you can copy a worksheet (or any parts of a worksheet) into the word processor. If you switch back to the worksheet and change data, the same data in the document changes accordingly.

You can even manipulate the worksheet while in the word processor. For instance, you can create form letters showing a graph of this week's sales versus last week's, and *Words & Figures* will display new graphs whenever the underlying data changes. If your job involves compiling regular reports based on your worksheet data, you could save a lot of time by generating them as form letters.

When it comes time to print out your worksheets and reports, *Words & Figures* shines there, too. It has several output options lacking in *1-2-3* Version 1A, notably support for the Enhanced Graphics Adapter (EGA), the *PostScript* page description language (for the Apple LaserWriter, for example), and the Hewlett-Packard LaserJet Plus. The *Words & Figures* hardcopy module (called PICPRT) looks quite a bit different than the *Lotus* PRINTGRAPH, but it offers pretty much the same options.

Telephone Support

Lifetree Software provides a phone number for answering technical problems related to *Words & Figures*. Although it's not a toll-free call, the phone is answered without much delay even during peak hours. During the course of preparing this review, I called several times without identifying myself as a reviewer, and each time I received prompt, courteous, and accurate answers. This kind of support is normally available only for much more expensive products.

For many people, *Words & Figures* is perfectly suitable as a primary spreadsheet. Although it may seem outdated by *Lotus 1-2-3* Version 2, there is a vast body of literature on Version 1A, and not everybody needs the horsepower of Version 2. The integrated word processor is good, and the enhancements (except for the still-missing undo function) read like every Version 1A user's wish list.

Words & Figures
Lifetree Software
411 Pacific St.
Monterey, CA 93940
$195

Have a question?
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Write to:
Readers' Feedback
COMPUTE!'s PC Magazine
P.O. Box 5406
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Star Fleet I

James V. Trunzo

Requirements: Any IBM PC, XT, AT, or compatible with at least 128K of memory, color/graphics adapter, and color monitor.

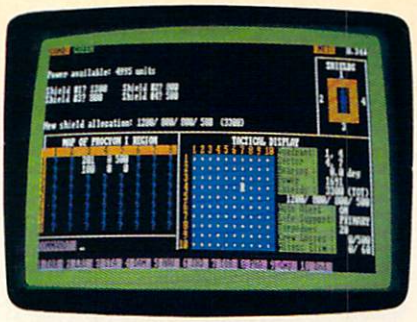
Star Fleet I is a strategic space-battle simulation. The game is, paradoxically, a mixture of elements from previous space war games yet an imitator of none. At first glance, *Star Fleet I* brings to mind the primitive graphics of the old *Star Trek* games; the flavor of Atari's video classic, *Star Raiders* (although there are no arcade aspects to *Star Fleet I*); and the depth of *Galactic Conquest*. However, *Star Fleet I* differs dramatically from any of those games. One of the factors that helps *Star Fleet I* achieve a unique identity is its degree of complexity.

It should be noted from the start that *Star Fleet I* is not for the novice or casual game player. The same depth and realism that make this product such an excellent simulation are the very factors that may discourage gamers looking for a fast-action shoot-em-up. *Star Fleet I* is a simulation/role-playing game and, by definition, this type of game strives for accuracy and detail, even if it is placed in a fictional setting.

Defending The Alliance

Star Fleet I seats the player at the helm of a galactic cruiser charged with the task of patrolling and defending the frontiers of the Alliance from invading aliens, specifically the hostile Krellians and Zaldrons. While the premise appears typical of space war games, perhaps even trite, the game mechanics soon dispel any suspicion that this game is commonplace.

Starting out as a rookie cadet in the Star Fleet Officers Academy, you are assigned a series of missions that vary both in degree of difficulty and in objective. This kind of on-the-job training gives you the opportunity to gain experience, learn, fight, and role-play at a level appropriate to your current status. A cadet would not be given tasks that would, more logically, require the skills and experience of a Commander, for example.



This feature results in a real feeling of actually "being there," of going through a growth period. The feeling is heightened by the promotions and awards which one can accrue throughout a career in the Star Fleet. Your successes and failures are recorded, and can easily be found by browsing through your Career Record (logged mission-by-mission by the computer). As a matter of fact, players can compete against one another, using promotion and awards as a yardstick to measure accomplishment. After each mission, your current standing toward promotion can be reviewed.

To play *Star Fleet I* with any degree of competency, it is essential that you read through the 100-page *Officer's Manual*. This task isn't as daunting as it may sound, because most of the pages contain diagrams, examples, and illustrations. In addition to the *Officer's Manual*, a 70-page *Training Manual* provides even more material. Both of these volumes are enjoyable to read and are quite helpful in playing the game. If you just can't wait, however, there's a quick-start method—but don't expect to survive long. Only the knowledgeable survive the Frontier.

You Are In Control

The instruction books hint at the sophistication of this game. It has more than 20 commands, all at your disposal as you take command of your cruiser. The screen provides you with all the details needed to monitor both your spacecraft and territory in which you are traveling.

The screen also provides you with a Long Range Scan, a Tactical Display, a Shield Display (when activated), and the Command Menu. Other onscreen or immediately accessible information includes current condition, damage control, messages from star bases under attack, time remaining on the mission, and so on.

All aspects of the game are under your control, and this, more than anything else, is what makes *Star Fleet I* addictive. You control four independent shields, deciding—among other things—how much energy to allocate to them. In combat, you decide whether to cripple and capture opposing ships or to destroy them completely. (You earn extra points—and status toward promotion—by capturing enemy vessels and personnel; tractor beams, transporters, and a cadre of space marines give you the means to do so.)

When your ship sustains damage, it's up to you to dock for repairs or to allocate energy to speed repairs while in space. You control the tractor beam, transporters, and space marines. You launch the long-range probes to report on unmapped sectors. You can even order your ship to self-destruct rather than let it fall into the hands of the enemy.

With 13 starship systems to defend, numerous missions to accomplish, and subtle strategies to master, *Star Fleet I* will keep all otherwise earthbound and frustrated Captain Kirks occupied for hours. *Star Fleet I* is a game that will delight the serious player—one willing to spend the time to learn and master its nuances. If you're that type of gamer and you've been looking for a challenge, *Star Fleet I* might be the end of your search.

Star Fleet I
Interstel
Distributed by Electronic Arts
1820 Gateway Dr.
San Mateo, CA 94404
$49.95

Chessmaster 2000

Selby Bateman, Associate Publisher

Requirements: Any IBM PC, XT, AT, or compatible with at least 256K of memory and DOS 2.0 or higher.

Chess is one of the most ancient and continuously popular games in human history, yet it's also one of the liveliest laboratories for the study of computers.

The analytical nature of chess naturally attracted scientists and mathematicians interested in the development of computing machines, such as Alan Turing in England and Claude Shannon at Bell Labs, during the late 1940s and early 1950s. More recently, computer programmers have continued to be attracted to computer chess because it can teach so much about the structure and interactivity of programs. And computers have answered the prayers of chess enthusiasts who almost always have trouble finding a human opponent when they get the urge to play a game: A computer chess program is always ready to go.

It's possible to find good chess programs for virtually every personal computer on the market. In fact, for many casual players, even a relatively simple computer chess game can offer a reasonable challenge. And the better programs have levels of play far beyond the average player's capabilities. For that reason, one wonders why it's so important that a computer chess program should be capable of beating all other chess programs—a frequent advertising angle. Instead, it seems more important that the program should offer a reasonably challenging environment with especially useful and interesting extra features and an easy-to-use playing interface.

The beauty of *Chessmaster 2000* is that you get it all: one of the most powerful chess competition programs available on a personal computer—with 12 levels of play (Newcomer to Grandmaster)—and an easy-to-operate, attractive playing environment that's loaded with helpful and intriguing features.

The Pop-Up Landscape

Chessmaster 2000 uses a pop-up menu system for the Help menus and for selecting various options. There are almost 60 different features you can access by pressing the function keys or a combination of the Ctrl and Alt keys. A six-page, fold-out guidebook gives you the details, and there's a handy alphabetized index of options on the last page. More than likely, however, you'll find that the options are easy to remember once you've played a couple of times.

For example, the Help menu pops up with a touch of the question mark (?) key; a Choices menu appears by pressing the F1 function key. Other function keys bring up menus for Playing the Game, The Chessboard, On-Screen Display, Instant Replay, Games On Disk, and Some Extras. A few of the menu items employ submenus to turn a feature on or off.

The screen that's loaded to start the game is a two-dimensional view of the chessboard, similar to other computer chessboards you may have seen. In addition to the board and the pieces, the screen also contains clock counters for White and Black and a listing area for each move as it's entered. Along the bottom and right side of the board, you'll see standard algebraic notation characters, the letters A–H and the numbers 1–8. When making a move, you can enter it algebraically if you're used to that, or you can move by simply shifting around an onscreen cursor by pressing the four arrow keys on the keyboard.

The two-dimensional board is easy to see, and the characters are outlined very well. However, you can change anything about the chessboard and its related displays quite easily, including going from two dimensions to three dimensions. By pressing the F3 key, you can then decide whether the board should be 2-D or 3-D; what colors you'd like the pieces, the squares, and the background; whether to have the alphanumeric notation and the clock and move displays visible; and whether you'd like to flip the board 180 degrees or 90 degrees in either direction. Those using a monochrome display adapter with a Hercules graphics card have the option of turning the graphics display on or off.

It should be noted that the three-dimensional display on the IBM PC and compatibles, while interesting to use at times, doesn't offer as clear a view of pieces, ranks, and files as the 2-D display. For most of your play, you'll probably end up using 2-D, flipping back to 3-D just for the novelty of it.

Modes Aplenty

As with most chess programs today, *Chessmaster 2000* offers you the opportunity to play against the computer, using either the black or white pieces; to play against another person; or to watch the computer play against itself. If you're playing a human opponent, *Chessmaster 2000* will monitor the game, not allowing illegal moves by either side.

In addition to the 12 levels of play, *Chessmaster 2000* also offers two other related functions that add to the variety. Easy Mode turns off *Chessmaster 2000*'s ability to "think ahead" while it's waiting for you to move. In other words, while you're trying to make your next move, the program is normally running through thousands of possible moves to counter what it thinks you may do. Use Easy Mode to stop that.

The other option is Newcomer Style, in which the program will play its easiest game against you. However, don't be discouraged if you lose against *Chessmaster 2000* even on that level, because there's another option made just for beginners or weak players who want to improve. By selecting the Teaching mode, the program will show you every possible move open to any piece you designate. And by choosing Get Advice, the program will provide a hint for your next move.

Chessmaster 2000 also offers several styles of play which you can choose from when playing against the computer. Normal style is a mixture of the best possible moves and some random moves; Best style permits the computer to make its best possible moves; and Coffeehouse makes the computer play more random moves—similar to the illogical moves that human players occasionally seem to make at crucial moments.

Thinking Ahead

One of the most valuable and engaging features of *Chessmaster 2000* is the option for showing the program's thinking. By pressing the Ctrl-S key, part of the screen gives way to a running display of the program's calculations about the next several moves. There are three lines of play displayed: Best, which gives the best possible move that *Chessmaster* has come up with so far; Current, which happens to be the particular move—good or bad—that the program is considering; and Previous, which is the line of play that would normally follow from the previous move. This last option is similar to another feature, called Best Variation, which is a display of the line of play the program is predicting from the last move.

The lines of play contain the sequence of moves, a score that the program keeps based on whether a particular move or moves will result in advantage to either side, and the depth of the search that the program is now undertaking. For anyone interested in improving his or her game, these windows on the program's thinking are both fascinating and extremely useful. Try a few of the variations that you always tend to use, and see what the program thinks of them. Are they strong lines of play? Are there better lines of attack or defense? What are a few new options you might try against those human opponents who always seem to beat you?

Not only can you study the program's thinking, but you can also select Analyze, and the program will take you through an analysis of each move in a game—any game—that you've played or that is loaded into the computer. Since *Chessmaster 2000* comes with a library of 100 classic games from 1620 to 1986, you can have the computer analyze each of them. Or, simply load a particular game, such as a Kasparov-Karpov contest or a Capablanca-Botvinnik game, and have the computer take you through it.

There are a host of additional options and features in this excellent package. Standard options such as saving games, setting up positions, and printing out listings are all here; and all of the rules of chess are followed, such as pawn promotion, *en passant* captures, and castling. A 20-page booklet covers the rules of chess, a history of chess through the ages, a list of the 100 classic games included on disk, and a few chess problems to solve.

Chessmaster 2000 is one of those rare programs for which it's nearly impossible to suggest improvements or additional features. This package should be in the library of any PC owner with even a passing interest in chess. And for the regular player at any level of play, it's a must.

Chessmaster 2000
Software Country
9713 Santa Monica Blvd.
Suite 204
Beverly Hills, CA 90210
Distributed by Electronic Arts
1820 Gateway Dr.
San Mateo, CA 94404
$39.95

PC

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HOW TO USE THE DISK

Every issue of COMPUTE!'s PC Magazine includes a 5¼- or 3½-inch disk as part of the package (newsstand copies contain 5¼-inch disks only; subscribers get their choice). If you experience a problem with the disk, please contact us at (919) 275-9809 from 8:30 a.m. to 4:30 p.m. Eastern time, Monday through Friday.

Before using the magazine disk, you should first make a backup copy. Format a blank disk with DOS system files and copy the entire contents of the magazine disk onto the backup disk. Then use the backup copy and keep the original disk in a safe place. This is important because some of the programs require COMMAND.COM and other DOS system files to operate correctly; making a backup copy on a disk which has the system files for your particular computer assures compatibility.

To make the backup disk, put your working copy of the DOS master disk in drive A and a blank floppy disk in drive B. Type FORMAT B: /S. After the formatting is complete, remove the DOS disk from drive A and insert the magazine disk. Type COPY A:*.* B: to make the backup copy. (If the computer you're using has only one floppy disk drive, consult your DOS manual for instructions on backing up disks.)

There are two ways to access the programs on the magazine disk. You can run a program by following the instructions in the corresponding magazine article. Or you can use the magazine-disk menu program to run the program of your choice. The menu program contains descriptions of each file as well as special instructions.

To run the menu program, insert the backup copy of your magazine disk in drive A and type DISKMENU or RUN at the DOS prompt. The menu program displays the disk directory and the title of the magazine article to which each disk file belongs. If there are too many disk files to fit on one screen, the menu program displays them in pages. To flip through these pages, press the PgUp and PgDn keys. You can exit the disk menu program to DOS by pressing the End key.

To select a program from the disk menu, press the corresponding number key; you'll see your selection at the bottom of the screen. You then have the option of reading a description of the selected program, running the selected program, or making another selection.

Some files on the magazine disk are not runnable programs—for instance, some files contain source code for programs included elsewhere on the disk in compiled, runnable form. The disk menu program won't let you run these non-executable files. Usually, these files can be displayed on the screen with the DOS TYPE command or can be printed out with the DOS PRINT command.

Important: Be sure to consult the corresponding magazine article for instructions before using any programs or files on the magazine disk.

There are four special files on the magazine disk which are required to run the menu program. These are DISKMENU.EXE, DIRFILE.TXT, DIRTEXT.TXT, and RUN.BAT. These files do not appear on the disk menu itself. Do not delete them if you intend to use the menu program. If you intend to use the menu program on a backup copy of the magazine disk, be sure these files have been copied.

With the exception of the featured program in our "Best of the Boards" column, the entire contents of COMPUTE!'s PC Magazine and the disk are Copyright 1987 by COMPUTE! Publications, Inc., all rights reserved. The programs are intended for use by the purchaser of the magazine and may not be distributed to others in any form. We ask that you respect the copyright. **PC**

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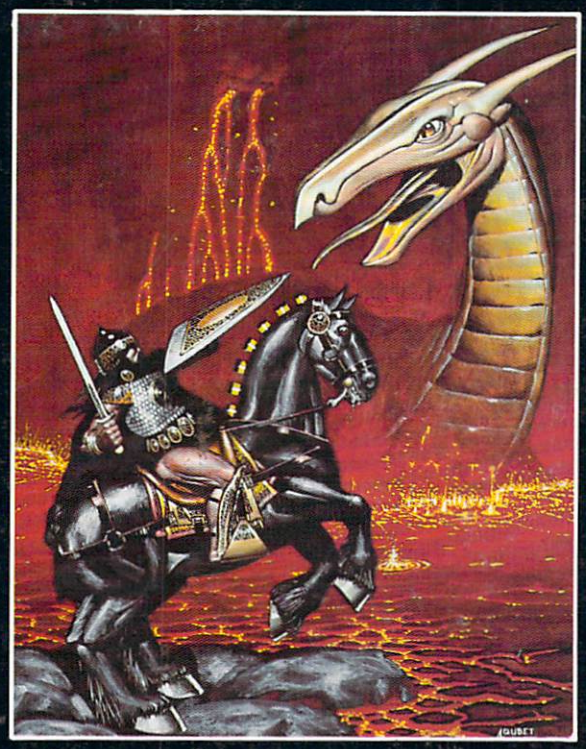

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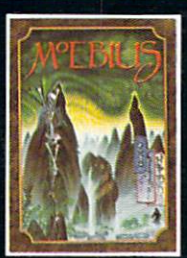

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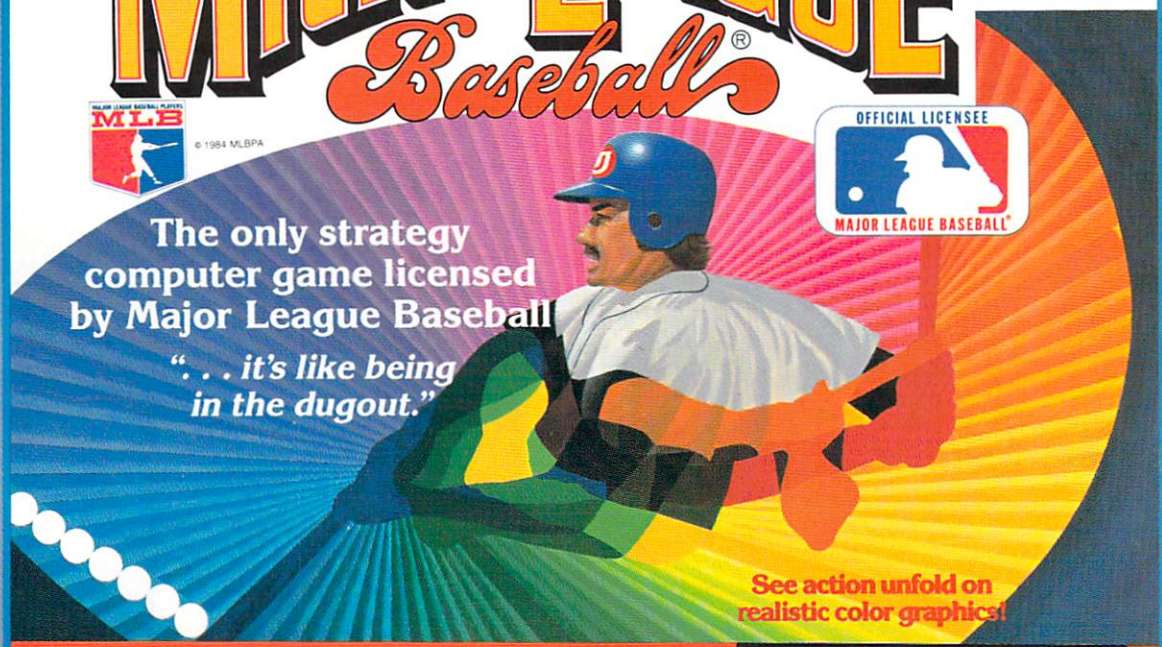

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